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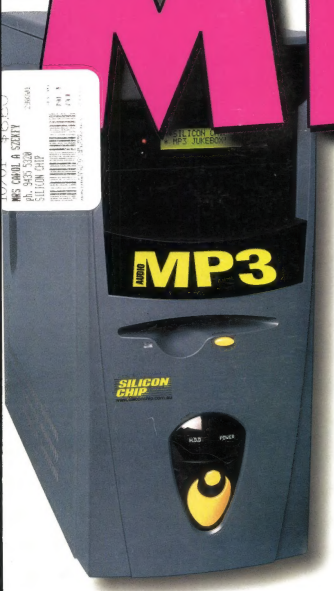

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- What's in MP3 for you?
- Rippers and Encoders
- MP3 I-R Jukebox To Build

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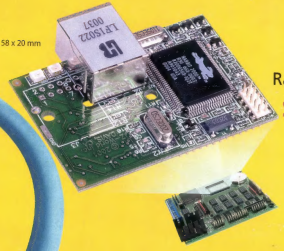

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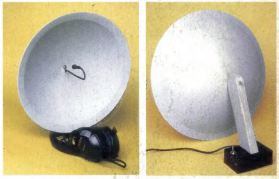

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PUBLISHER'S LETTER

MP3 format will change our music listening

This month we have put a big effort into producing articles on MP3. The first is the general article on the MP3 format written by Jim Rowe and starting on page 6. The second, written by Greg Swain and starting on page 12, is more into the nitty-gritty of down-loading .WAV files and converting them into MP3 format. Finally, the third article by Peter Smith and starting on page 24, is the first of a series on building an MP3 player based on an old computer – not too old mind you, since it needs to be a 133MHz Pentium or better, with a big hard disk.

In spite of the vast amount of work that we have put into the MP3 articles in this issue, I have mixed feelings about MP3. On the one hand it is growing enormously in popularity as people use it to download and copy all sorts of music in a format which is potentially high quality, very compact and easy to play, although currently available portable MP3 players are an expensive item.

On the other hand, in the form that most people appear to use it, MP3 is the garbage music medium. In effect, it is the digital equivalent of the old tape cassette where ease of use won out over sound quality. In fact, most tape cassettes were recorded without the aid of Dolby noise reduction which was able to greatly improve the sound quality. And so it is today. MP3 is a potentially very good sound recording medium but is mostly used in the more mediocre modes where people get more recording time and less quality. Partly, people are forced into this situation by the limitations of the hard disk in their computer and the lack of speed of the internet.

So while some people will accuse me of being elitist, I hate the idea of a recording medium being used at far less than its optimum. So in spite of there being rough equivalence between the better modes of MP3 and CDs, CDs ARE much better than the more compressed forms of MP3.

We also have the interesting situation where audio manufacturers are pushing the CD medium to new highs with the development of SACD (Super Audio Compact Disc) and the DVD manufacturers are pushing the development of DVD Audio (ie, with six channels of digitally recorded audio). In the meantime, most of the population is supposedly quite happy to live with much more mediocre sound fare on MP3 and so on. I suppose there is a parallel here between high definition TV and the poor quality pictures that most of the population seem quite happy to watch.

I hope that as time goes on, MP3 will continue to be developed and that people gradually raise their listening standards to the full potential of the medium. It can provide a great listening experience – why not use it to the fullest?

Leo Simpson

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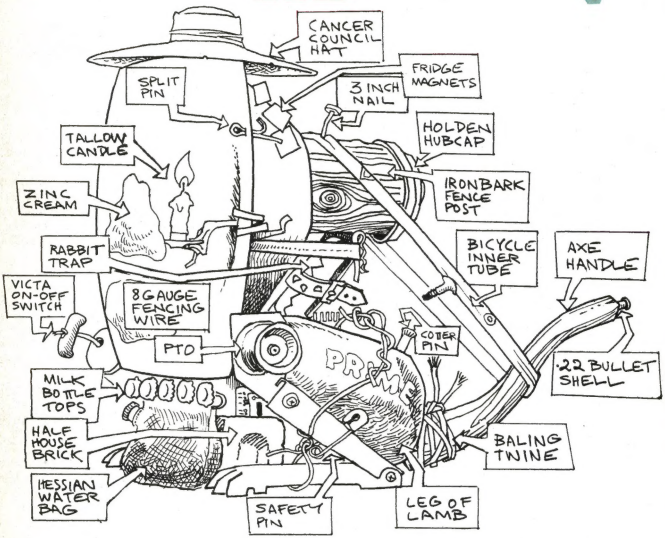

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MAILBAG

Practical electric vehicle wanted

I wish to congratulate you all on a mighty fine magazine. I am wondering if you would ever consider designing a project for a practical electric vehicle, using an ordinary 3-phase AC induction motor and an inverter power supply, possibly with IGBTs and controlled by a PIC. AC induction motors have the advantage of having no brushes and are easily obtained. PICs have all the advantages that you already know about!

Ian Horacek,
Melbourne.

Comment: we have often mulled over the idea of a designing an electric vehicle using, as you suggest, a 3-phase induction motor and a variable frequency/variable voltage supply, possibly running from a 240V battery bank (no inverter required and we'd use an American 220V 3-phase motor, rated at several horsepower).

Even so, this would be a major engineering exercise, and more so if you wanted to incorporate dynamic braking and regeneration. That's why we have only thought about it, rather than actually doing anything. The approach used in golf buggies etc, using a DC motor, is much more practical.

Widescreen on DVD, PAL vs NTSC and DVD Zoning

As consumers, are we being conned with the hype of widescreen format, especially on DVD? Why I am asking this is because I was at a friend's place a few weeks ago watching 'What Women Want' on video. It was in 4:3. A week later I hired it on DVD. I accepted the fact that this was presented in 16:9 wide-screen format but as the movie progressed I realised it wasn't widescreen at all. It was just the 4:3 picture with black bars top and bottom. When I returned the DVD to the video store I had a few words to say to the staff, not at them, but about the industry. I then asked if I could get a comparison done in store and they saw what I saw.

Out of curiosity, when Channel 7 screened Titanic recently, I did the same test as the DVD is in 2.35:1. Again the DVD had less picture top & bottom; ie, foreheads chopped off, etc.

I thought widescreen was supposed to give more picture on the sides, not less picture top and bottom. On the point of 2.35:1, is there something special about 4:3 as 16:9 is $[4:3]^2$ and 2.35:1 is very close to $[4:3]^3$?

Getting back to my gripe, as a result of this cropping we appear to be losing 25% of the DVD picture to black bars in 16:9 and 44% to 2.35:1, so am I correct in saying that when a 2.35 picture is enlarged to fit on a widescreen TV, the resolution would be 56% of the supposed 500 lines or about 281 lines?

On another issue, in broadcasting, PAL is 625 lines while NTSC is 525 lines and claims are made of how superior the PAL picture is. When it comes to DVD or Standard VHS, how can the same claims be made. With DVD, 500 lines is 500 lines, be it PAL or NTSC, and 250 for VHS. Wouldn't that give NTSC the edge, as it has 30 frames per second to PAL's 25?

Australia is a PAL country, though I am noticing more and more DVDs for sale in the NTSC format. Is this because Zone 4 includes Mexico, which uses NTSC, and we are receiving their overflow? Maybe I'm missing the point and require therapy, or am I right and brave enough to speak out?

Simon Kareh,
via email.

BWD 820 oscilloscope schematic wanted

My faithful BWD 820 oscilloscope which must be late 70s vintage refuses to sync to any source, even its own calibration square wave. On inspection, it is easy enough to identify the relevant section although a quick meter check of components reveals no culprit.

Before I embark on the arduous task of tracing the circuit, I wonder if any SILICON CHIP reader has a schematic or know where I could get one?

John Hansen,
12 Maskells Hill Rd, Selby Vic 3159.
vcontrol@ozemail.com.au

Unnecessary licensing is not the answer

I have just read the discussion in your magazine for July on electric wiring and thought I would submit my view. If Australia is ever to become the "Clever Country", it must be through education of the population in the correct techniques and safety procedures in multi-discipline fields which include electrical wiring.

In my opinion, unnecessary licensing is not the answer to accident prevention in the gamut of "Occupational Health and Safety". We license those that drive motor vehicles, marine licensing and pilots to fly aircraft, etc and accidents still occur in abundance in all of these areas.

It is in the education of the people in correct procedures as in New Zealand and other countries and not by restrictive licensing. If we continue down the let's "license everything" path, Australia will not be known as the "Clever Country" but as the "cow's tail" of the world – always behind.

C. Bird,
Anstead, Qld.

Electrical regulations are highly discriminatory

Let's hope the campaign to change the electrical regulation works so that the discrimination ends!

Personally, this is a very big threat, being qualified in electronics and having received extensive training locally and overseas to handle LV, MV and HV systems (from 6V to 32MeV) as part of the job when working on medical diagnostic imagining equipment. I have in my time worked on substations, computers, radio, rewound 6.6kV DC and AC motors used for

railway locos – the complete range of "volts" – and I am aware of the "bite" you can get. Yet I see it as discriminatory that I am effectively not allowed to do what I have been trained to do, because of some less than sensibly thought out legislation.

This borders on the ridiculous, just the same as I faced trying to get an electrical licence. I asked the chief Electrical Inspectors office how I could get registered as an electrician and was sent packing, as I am too old to do an apprenticeship. Apparently this is the only way I can get a licence!

How discriminatory, as I wanted to set up my own business and felt I would "do the right thing" and get licensed. No go. I can do the work but have to have a registered electrician come and check it over. Some of them have never seen the inside of 66kV substation let alone gone in and cleaned up the mess after one of the switch racks blew up!

I hope your campaign bears fruit.

T. Bradley,
Ferntree Gully, Vic.

People should not do their own wiring

I have been reading your publication for 15 years. Nothing struck me as being quite so silly as the idea of people undertaking their own house wiring and repairing their own appliances. In the time I have been an electrician, I have witnessed some amazingly dangerous handywork after someone has" had a go" at something and then brought it to me for correct repair. As for the service technicians, just because you work on TVs and videos does not mean you can work on consumer power safely.

To become an electrician, as you know, takes four years of study and practice and I can assure you that there is much to learn. This is not withstanding industrial electrics, which is another world entirely. I feel a bent towards slander at some of the replies I have read toward electricians from your tech readers but I can assure you if you don't know what you're doing, as with anything, you can come unstuck badly. What I would also like information about is the insurance company's point of view on an unqualified person doing the wiring. Will they cover you?

I for one would not undertake any work on a premises that had been wired by an unlicensed person, insurance and personal safety being foremost to my mind.

Just in closing, my personal favourite is the one where Joe Bloggs makes his own extension leads and gets the Active/Neutral around the wrong way. He claims it's fine as the lead works anyway. If you want to work on certain things, at least get a restricted electrical licence for that purpose, so you are at least conversant with what you're doing.

Before you techs jump up and down, remember that dealing with 0.5A requires a different mindset than dealing with 50A. Bet you don't print this.

Peter Raffaelli,
via email.

Comment: 12 months ago, we would have mostly agreed with you but the fact that New Zealand, most of Europe and the US allow people to do their own wiring shoots your whole argument to pieces.

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MP3

Changing the way you listen to music

MP3 is the new music buzzword. It "crunches" bloated audio tracks into compact files, for playback via your PC or a dedicated MP3 player. What's in it for you? – read on and find out!

By JIM ROWE

DESPITE THE JARGON, there's nothing magical about MP3; it's simply a technique for compressing digital audio, so that it needs less storage space and is faster to transmit from one place to another – via the Internet, for example.

In many ways, MP3 is rather like the JPEG format that's used to compress digital image files, so that more of them can be stored on your PC's hard disc. In fact, the MP3 version of a piece of music can be 12-14 times smaller than the equivalent WAV file but still sound almost identical.

You can get an even better appreciation of just how effective MP3 is by looking at file sizes. Typically, a 4-minute CD-quality music track occupies about 45MB of disk space in WAV format but this shrinks to only about 4MB in MP3 format for near-CD sound quality. That's a saving of about 40MB per track or 800MB for a 20-track CD!

If necessary, even greater file compression ratios are achievable – it all depends on how much sound quality you're willing to sacrifice.

Table 1: Bit Rate vs. Performance

Bit Rate (KB/s)	Mode	Compression Ratio	Bandwidth	Sound Quality
192	Stereo	7:1	>15kHz	Archival quality
160	Stereo	8.4:1	>15kHz	Archival quality
128	Stereo	10.5	>15kHz	Near-CD quality
96	Stereo	14:1	15kHz	Sub-CD quality
64	Stereo	21:1	11kHz	FM radio quality
32	Stereo	42:1	7.5kHz	AM radio quality

Is it legal?

Being able to use a technique like MP3 to "shrink wrap" music into much smaller electronic packages has made it easier for people to swap music files over the Internet. It's this aspect that the music industry doesn't like, because the popularity of MP3 and other digital compression techniques has resulted in a dramatic increase in music "piracy".

However, just because people use MP3 to illegally obtain (or distribute) copyright music doesn't mean there's anything illegal about MP3 itself. MP3 is really nothing more than a file format and a lot of MP3s that are available via the Internet are quite legitimate. MP3s are often posted on the Internet by new bands as a means of self-promotion, for example.

You can also make MP3s from your own audio CDs, LPs and tapes although, technically speaking, this can constitute a breach of copyright. However, many people take the view that it's OK to copy provided they own the recordings and the MP3s are for personal use only.

There are plenty of software tools available for "ripping" tracks off an audio CD and storing them on your hard disk in WAV format. After that the audio data has to be encoded in MP3 format. Some programs only do ripping while others only do encoding but there are also plenty of combination ripper/encoders available.

Microsoft's "Windows Media Player 7" can play MP3s, conventional audio CDs and a host of other audio formats as well. It includes a playlist editor, supports extracting track titles from a CDDB and there are a number of interesting "visualisation" effects to choose from during playback. You can also customise the appearance of the player by applying different "skins".

Many of these software tools are available as freeware or shareware and can be readily downloaded from various sites on the Internet. You'll also find MP3 rippers/encoders on computer magazine cover CDs. We'll take a closer look at making your own MP3s later on.

Why compress?

As you're probably aware, audio CDs and other digital media store music as a stream of binary numbers (ie, 1s and 0s). Each number specifies the amplitude of the original analog audio signal at a particular sampling instant. In the case of an audio CD, the sampling rate is 44.1kHz – ie, there are 44,100 samples every second – for each of the two stereo channels and each sample is stored as a 16-bit binary number.

This means that for every second of a stereo recording, 88,200 of these 16-bit numbers must be stored on the CD. So when you're playing the CD, the digital music "data" has to be read off the CD at the rate of 1,411,200 (16 x 88,200) bits per second, or about 1.33Mb/s (megabits per second).

In practice, the total data rate when you're playing a CD is actually about three times this, or about 4.3Mb/s, because additional "housekeeping" data is needed for error correction, etc. After decoding and error correction, the 16 bits for each audio sample are fed through digital to analog converters (DACs), to deliver the two analog audio signals for a stereo amplifier.

This type of digital recording is known as "linear pulse-code modulation" (or LPCM), because of the way it saves the samples as "code" numbers whose binary value corresponds directly to the amplitude of the original audio at the sampling instant. LPCM certainly delivers excellent audio quality but this comes at a fairly heavy price in terms of data storage space and transmission time.

The Creative Nomad IIc personal MP3 player connects to your PC's USB port, comes with 32MB of RAM and costs $299 from Dick Smith Electronics. Also available from DSE is the deluxe Nomad II model for $398.00.

Even in its "raw" form as a WAV file on a computer hard disk, 16-bit/44.1kHz LPCM needs 1,411,200 bits or 176,400 bytes of storage space for every second of stereo audio. That's just over 10MB (megabytes) per minute, which is why you need a big hard disk if you use your PC to make your own audio CDs.

You can also see why LPCM isn't really suitable for carrying the audio for digital TV or radio, or for sending music over the Internet. Even a 3-minute pop song would involve over 30MB of data, which would take about 93 minutes to download using your 56.6KB/s modem!

Packing it in

There are two different ways of compressing digital data. One method simply involves analysing the data for redundancy (ie, data repetition) and then encoding it more efficiently. In other words, it "packs" it more tightly and efficiently. At the other end, mirror-image decoding techniques are used to expand it again, restoring the original data exactly.

This is known as "lossless" compression and it's the kind of compression used for squeezing computer data into "zip" files.

Lossless compression can achieve fairly large reduction factors with data that has a lot of redundancy, such as video (where one field image is often almost identical to the one before). But it's not as effective with data that doesn't have much redundancy, like music or speech.

That brings us to so-called "lossy" digital compression. It is called "lossy" because it prevents the data from being restored exactly to what it was before – just "near enough" for practical purposes. These techniques are based on the idea of "perceptual coding", which involves analysing the data on the basis of what we know about human perception (sight and hearing) and looking for content that either won't be perceived or is un-

continued on page 10

Psychoacoustics: Fooling The Ear

AS YOU MAY already know, a typical normal ear's frequency response varies considerably over the audio range and is also quite dependent on the volume of the sound. Our hearing is most sensitive at about 2-5kHz and least sensitive at frequencies below 100Hz. The response also varies a lot more at low volume levels than at high levels.

In other words, our ears are quite non-linear and have a rather bumpy frequency response to boot.

More recently, it's also been discovered that because of the way our hearing receptor "hair cells" work inside the ear's cochlea, the ear isn't very good at hearing all of the components of a complex sound. In particular, a loud sound at one frequency tends to dominate our perception of all sounds in a band of frequencies, extending either side of the lound sound. This is called "masking" and is illustrated in Fig.1.

What happens is that a relatively loud sound (signal A) "pulls up" the ear's hearing threshold at frequencies on either side, so that if there are other sounds present in that frequency band at a lower level (like sound B), they simply won't be heard. Essentially, the lower level sounds are "masked out", because of the way our hearing receptors are desensitised at frequencies on either side of sound A.

In practice, the width of this masking effect varies logarithmically with frequency. For example, a loud sound at 100Hz masks out other sounds from 50-150Hz, while another at 1000Hz masks out sounds from 500-1500Hz and one at 10kHz masks frequencies from 5-15kHz. The higher the frequency, the wider the masking curve in Hertz – see Fig.2.

The width of these masking curves also varies with the volume. At low levels, only frequencies quite close to the main sound are masked but the masking widens as the sound level is increased – Fig.3. This means that the ear is best at distinguishing adjacent sound frequencies at low volume levels.

There's another aspect of masking, too. As well as varying with frequency and volume, masking also varies with time. So when a fairly loud sound A starts at time T1 and ends at time T2, its masking effect doesn't just last while it's present but fades away relatively slowly after it ends (Fig.4). It can even start slightly before the loud sound is perceived – called "pre-masking".

This "temporal masking" effect also varies with the duration of the masking sound. The masking fades relatively quickly after brief loud sounds but takes longer to fade after long-duration loud sounds.

So it's been established that weak sounds at frequencies close to louder sounds simply can't be heard. In addition, the masking effect varies with frequency, volume and time duration in a fairly predictable way. It's this knowledge that is used to program the operation of perceptual encoders, like those used for MP3.

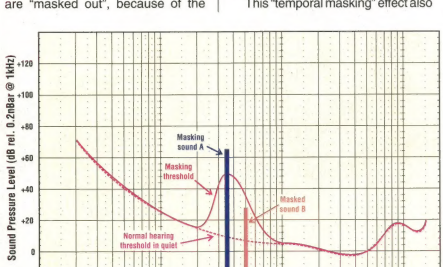


Fig.1: when you're listening to a reasonably loud sound, you can't really hear quieter sounds nearby — due to the masking effect.

Encoder operation

Without going into things too deeply, the encoders operate in two main ways. First, they decide which audio components can safely be removed, because they'll be masked and inaudible anyway – so they're perceptually redundant.

Second, they make decisions regarding how many (or how few) bits need to be used to encode the audio, on a dynamic "instant by instant" basis. To allow this to be done, the analog signal is not converted to digital samples as a single entity but is first filtered into a set of frequency sub-bands – typically 32 – with bandwidths of about 1/3 of an octave. The signal components in each sub-band are then sampled independently and the encoder then analyses each of their amplitudes.

Then, by predicting the way the ear will handle each of these sub-band signals and the interaction between them, the encoder decides how many bits are needed to convey each one with sufficient accuracy and clarity. Louder sub-band components will be encoded with a larger number of bits and softer components with a smaller number of bits. Sub-bands where the signal level is below the threshold of hearing aren't even encoded at all.

This is called "adaptive sub-band coding".

What's the point

But what's the point? Well, you'll recall that LPCM uses a brute-force

approach, with fixed-length 16-bit numbers to represent every sample of the signal regardless of its amplitude. This gives low "quantising noise" (theoretically -96dB below maximum level, for 16-bit sampling) and hence a large dynamic range. If we reduce the number of bits used to represent each sample, this lowers the amount of digital data being sent but the sampling would be cruder – ie, the quantising noise would increase.

In fact the noise increases by 6dB each time we use one less bit, so if we drop to only 8-bit sampling we get a signal-to-noise ratio of only 48dB.

So although 8-bit LPCM gives half the file size and transmission time of 16-bit LPCM, it also sounds pretty terrible. And 4-bit LPCM would be even worse.

Varying the bits

On the other hand, by combining sub-band coding with a knowledge of the ear's behaviour, it becomes possible to vary the number of bits used to encode each of the signal components, so that the quantising noise in each sub-band is still kept below the ear's threshold of hearing (taking into account the effects of masking). This is done dynamically, so that the number of bits needed to convey the signal is not fixed but varies up and down, depending at any time on the signal itself.

The net result is a dramatic reduction in the total number of data bits needed to store or transmit the audio, but with almost no "perceptible" difference in the sound of the signal decoded at the other end.

Note that the decoded audio signal may well end up lacking many components or details that were in the original and may also have quite a bit of additional noise due to the cruder sampling of quieter signal components. But the crucial point is that these shortcomings are near enough to inaudible.

If all this sub-band filtering, analysis and adaptive coding sounds pretty complicated, that's because it is. In fact, this whole approach to signal compression only became feasible in the last 15 years or so, with the development of digital filtering and signal processing techniques.

It certainly wasn't possible back in the old analog days but now it can all be done digitally by some dedicated LSI chips or software running on a PC.

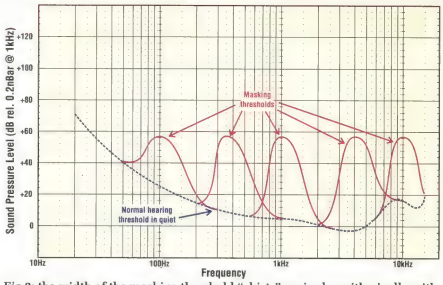


Fig.2: the width of the masking threshold "skirts" varies logarithmically with frequency.

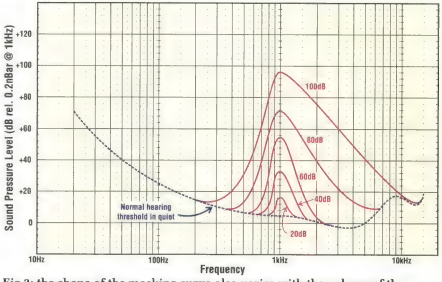


Fig.3: the shape of the masking curve also varies with the volume of the masking sound, being much wider for loud sounds.

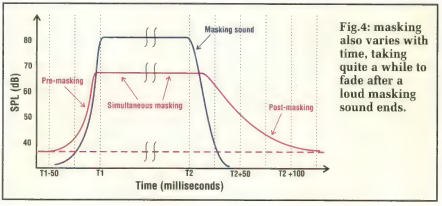


Fig.4: masking also varies with time, taking quite a while to fade after a loud masking sound ends.

MP3 Changing the way you listen to music – ctd from page 7

likely to be missed if it's removed.

The data that's judged as "perceptually redundant" is then removed, allowing the remaining data to be compressed considerably. In other words, some of the audio information is "thrown away" on the basis that you won't be able to hear the difference.

By the way, lossy and lossless compression aren't mutually exclusive – you can use them both together, for even more efficient data reduction. It's this kind of "double shot" compression that's used to squeeze up to two hours of digital video and 5.1-channel audio on a DVD and to pack up to 74 minutes of high quality stereo on a MiniDisc.

It also happens to be the kind of compression used in MP3, to crunch down digital audio files by a factor of 10-14 times or more.

But how does the perceptual encoding part of lossy compression actually work? And how does the audio encoder decide which parts of the data can be safely chopped out, without being missed? Take a look at the accompanying panel on psychoacoustics to find out more on this subject.

MPEG-1, Layer 3

Now we've looked at the broad principles on which digital audio compression are based, let's turn our attention to MP3 itself. By the way its full official name is "MPEG-1 Layer 3", which reveals that it's one implementation of the group of digital data compression technologies known as MPEG-1, developed and standardised by the Motion Picture Experts Group.

MPEG-1 began as a technology to compress digital audio and video so they could be stored on CDs – ie, for video CDs. As such, MPEG-1 audio encoding was developed from two earlier technologies called MUSICAM (Masking-pattern Universal Sub-band Integrated Coding And Multiplexing) and ASPEC (Adaptive Spectral Perceptual Entropy Coding).

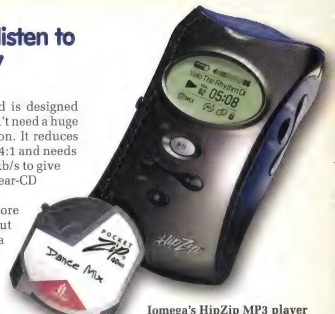
There are essentially three "layers" of MPEG-1 audio encoding, each involving a different level of processing complexity and offering a different degree of compression or "data reduction". Layer 1 is the least complex in terms of processing and is designed for applications that don't need a huge amount of data reduction. It reduces the audio data by about 4:1 and needs a data rate of about 384kb/s to give stereo reproduction of near-CD quality.

Layer 2 involves more complex processing but reduces the audio data by between 6:1 and 8:1. It gives near-CD stereo reproduction at data rates of 192kb/s and above. Layer 2 is used for the audio on video CDs and for digital TV audio.

Layer 3 (ie, MP3) involves the most complex processing, but also achieves the highest degree of data reduction – between 10:1 and 12:1. This allows it to provide near-CD stereo reproduction at data rates of 112kb/s or 128kb/s, or "FM stereo" quality at 64kb/s (21:1 reduction). Even a data rate of just 32kb/s can give respectable "AM mono" quality, with 15kHz sampling and a bandwidth of about 7.5kHz –see Table 1.

Obviously, the big appeal of MP3 is this ability to give near-CD quality stereo with files only 1/12 the size of LPCM files, or FM stereo quality with files half that size again. That's why it's become so popular for downloading music files over the Internet – because an MP3 file of a typical 3-minute song might take only seven or eight minutes to download, instead of 90 minutes or so for the equivalent WAV file.

This also makes MP3 files very attractive for storing music on a PC hard disk or in the memory chips of a portable MP3 music player. As stated earlier, MP3 lets you cram a complete 4-minute track into just 4MB for near-CD quality but if you're happy with lower quality, it can be even smaller.



Iomega's HipZip MP3 player uses 40MB PocketZip disks as the storage medium.

MP3 for all

How can you take advantage of MP3 yourself? Well, there's two fairly easy ways to get MP3 music files.

One way of getting MP3s is to download them from the Internet, from the many web sites that specialise in making MP3 files available. Popular sites for this are **www.mp3.com**, **www.scour.net** and **www.riffage.com** but be warned – they're often very busy and your browser may not be able to access them.

One obvious drawback here is that the web sites may not have the particular pieces of music you want. They're a bit of a lucky dip in this regard.

The other main way to get MP3s is to make them yourself (see "Making MP3s"), by converting the tracks on existing audio CDs, LPs and tapes. This involves using a PC with a CD-ROM drive plus some readily available software. It's a two-step process: you first turn the music into a WAV file (known as "ripping"), then encode it into an MP3 file (the "encoding" stage).

To convert a track from an audio CD, for example, you first need to read the track and save it on your hard disk as a WAV file. This can be done

Looking for MP3 music software? If so, www.mp3.com is the place to go.

using either one of the common music editing programs (like Cool Edit, Sound Forge or CD Spin Doctor) or a ripper program. Many of these can be downloaded from the Internet, from sites like **www.mp3.com**

Similarly, with a track from a tape or LP record, you again have to use one of the music editing programs to record it through your sound card.

Once you have the music on your hard disk in WAV file form, you then use an MP3 encoding program to produce the MP3 equivalent file. Again there are many MP3 encoding programs that you can download from the net. Alternatively, you can get a combined ripper/encoder that does everything in one seamless operation.

Playing MP3s

Once you have the music you want in MP3 form, there are various ways you can play it. One way is to play it on your PC via its sound card and amplifier/speakers, using an MP3-capable software program. If you're running Windows 98/Me/NT, the latest Windows Media Player will play MP3 files directly (as well as conventional audio CDs).

Alternatively, you can use a freeware MP3 player such as "Winamp". As before, you can download these players from web sites like **www.mp3.com** or from a computer magazine CD-ROM.

Another approach is to record the MP3 files on a CD-R disc, using your CD-writer drive and a program like "Easy CD Creator". You can then play the files from the disc, either on your PC using Windows Media Player or Winamp, or on one of the latest DVD players that can play CD-R discs with MP3 files.

MP3 on the move

Yet another approach is to download the MP3 files from your computer into one of the shirt-pocket sized portable MP3 players, like the Diamond Rio 500 or 600, or the Creative Labs Nomad II. Many of these players have a USB port, so you can download the files into the player's memory chips or card quite quickly. Most of the players can store up to an hour or so of high-quality 128kb/s stereo.

In short, MP3 is quite a useful tool for making digital audio widely available in surprisingly compact form. No wonder it's become so popular! **SC**

Silicon Chip's MP3 Jukebox

Our MP3 Jukebox is basically a standard PC fitted with an infrared remote control receiver and an LCD screen to display the track titles. The universal remote control handpiece lets you select from up to 99 playlists, each containing up to 199 songs – just by pressing the buttons.

HERE'S A FANTASTIC WAY to play your MP3s. What we've done is design a remote control receiver and LCD display that plugs into the serial (RS232) port of your PC and is controlled by a universal remote control.

An accompanying software program interfaces the unit with Winamp. With this setup, you can play your MP3s by remote control and all the track data is displayed on the LCD. The remote can select between 99 playlists, each listing up to 199 songs.

You can either build the remote control receiver directly into your PC or mount it externally. In fact, it doesn't even have to be in the same room as your PC. Instead, you could mount the remote control in your loungeroom and connect it via a serial (RS232) cable to a PC located in an adjacent room – eg, a bedroom or study.

Of course, you would also have to run audio cables to connect the output from your PC's soundcard back to your amplifier. You have to keep these cables short, though – any more than 4-5 metres and you could quickly run into hum and stability problems (not to mention high-frequency losses).

One neat solution is to use a dedicated PC as an MP3 Jukebox. This could be sprayed charcoal gray and mounted next to your existing hifi gear. Once it's working, you don't really need a keyboard, mouse or monitor, since our remote control setup lets you power the unit down when not in use (provided you have an ATX motherboard, that is).

In short, it's up to you how you use the remote control unit. The first article on our MP3 Jukebox is on page 24 of this month's issue.

Making MP3s: Rippers & Encoders

By GREG SWAIN

IN ORDER TO MAKE your own MP3s you'll need ripping and encoding software. A combined ripper and encoder that can extract tracks from a CD and convert them into MP3 format in one seamless operation is usually the most convenient. However, there's nothing to stop you from using one program to rip the tracks to WAV files and then using another program to convert them to MP3 format, if that's what you prefer.

You'll also need a reasonably fast PC with a modern CD-R that's capable of digital audio extraction (these CD-Rs are normally branded DA). If the CD-R doesn't offer digital audio extraction, the sound must be sampled via the sound card and this gives somewhat lower quality (depending on the card itself).

The main factor to consider when making MP3s is the bit rate. Higher bit rates produce better sound quality but they also create larger files. Table 1 on page 6 shows the bit rate options that are commonly available and the resulting sound quality.

Generally, the settings to go for are: 128kb/s bit rate, 44.1kHz sampling and stereo – see Table 1. This will give good-quality sound but at the same time keep file sizes down, with a compression ratio of about 10.5:1. By contrast, a bit rate of 192kb/s gives a compression ratio of about 7:1, which means that the file sizes are about 50% bigger than at 128kb/s.

That mightn't sound like a lot but it can be important if you're trying to squeeze the maximum number of tracks into the memory of a portable MP3 player.

If file size isn't critical, try increasing the sampling rate from 128kb/s to 160kb/s. This will give slightly better sound quality for only slightly larger file sizes. There can also be variations between different MP3 encoders, so you might like to experiment here. The Lame, Fraunhofer and Blade encoders are all reputed to produce good results.

Most encoders set the sampling according to the bit rate selected. However, some of the fancier encoders give you a choice of sample rates – eg, 16kHz, 24kHz, 32kHz, 44.1kHz and 48kHz. Audio CDs have a sample rate of 44.1kHz, so there's usually nothing to be gained by going higher than this. Lower sampling rates will reduce the file size but high-frequency losses quickly become noticeable.

Some encoders also have a variable bit rate (VBR) option. When selected, this allows the program to automatically vary the bit rate according the frequencies present, so that the file size is kept to a minimum. Encoders with this feature also often let you set the minimum bit rates.

Typical ripper/encoders

Not looking to spend any money? Then take a look at CDex v1.40 (Beta6) – see Fig.1. This freeware MP3 ripper/encoder offers all the functions you could want, including the ability to rip tracks off a CD and save

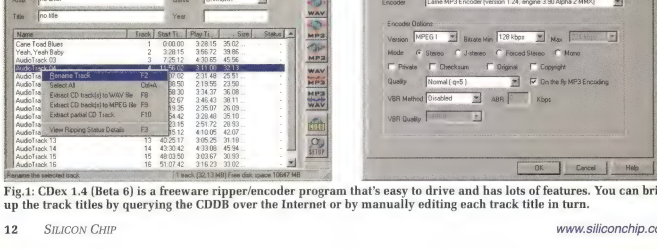


Fig.1: CDex 1.4 (Beta 6) is a freeware ripper/encoder program that's easy to drive and has lots of features. You can bring up the track titles by querying the CDDB over the Internet or by manually editing each track title in turn.

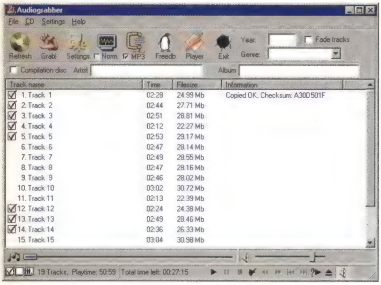


Fig.2: Audiograbber 1.8 is a comprehensive ripper/encoder but it will cost you $US25 for the non-crippled version.

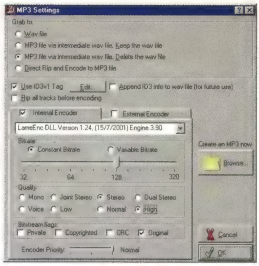


Fig.3: Audiograbber's "MP3 Settings" dialog lets you adjust the bit rate and choose the encoder to be used. If you want an internal encoder, just copy lame_enc.dll to the same folder as "audiograbber.exe".

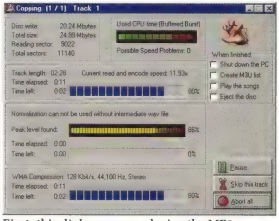


Fig.4: this dialog appears during the MP3 conversion process in Audiograbber.

them in WAV or MP3 format in one operation. It can also convert existing WAV files on your hard disk to MP3s and even convert MP3s to WAV files, in case you want to record your MP3s in a format that can be read on a conventional audio CD player (eg, in your car).

There's also support for different bit rates (including VBR) and there's a selection of inbuilt encoders (CODECs) to choose from. The default is the Lame MP3 encoder which gives excellent results. An interesting option is the inclusion of the Windows WMA encoder, which produces compressed files that can be played on the Windows Media Player.

It's easy to use. To rip files off an audio CD, you simply load the program and place the CD into the drive. This brings up a list of tracks as shown in Fig.1, after which you can select one of more tracks and convert them to WAV or MP3 format.

The track titles in Fig.1 are shown as AudioTrack 01, AudioTrack 02 and so on but you can rename them before ripping by right-clicking each file in turn and typing in the correct track title.

If that sounds like a lot of work (and it is), there's an easy way out. In common with many other ripper/encoders, CDex supports a feature called "CDDB", or CD Database. This is basically an Internet database that identifies the CD and automatically supplies the track titles, the CD title and the name of the artist.

In fact, there are two CD databases that you can use – cddb and freedb – and CDex uses the latter by default. Of course, you need an Internet connection in order to query a database. And that's where there's a trap – if you enable the "auto-connect" feature in CDex, the program will automatically dial out and connect as soon as the CD is loaded. Unless you have a permanent connection, you're much better off just clicking the "CDDB" button on the righthand edge of the window when you're ready.

An alternative is to use the CDDB that's supplied with some CD-ROM burning software. In the case of Nero 5, for example, you just copy the cddb.zip file to your hard disk, unzip it (you'll need about 130MB of free disk space) and then enter the path to this file in the relevant setup window of your MP3 encoder.

ID3 tagging

Another feature offered by CDex is ID3 tagging. This allows you to enter in text information about each track – eg, the track title, artist, year and comments – which is then subsequently displayed by the MP3 player. The ID3 tags are written to the end of each MP3 file.

Creating a playlist

How do you get you MP3 player to automatically play a list of MP3s?

Answer – you need to create a "playlist". This is nothing more than a text file that contains a list of MP3s and you can add or delete tracks from the playlist simply by editing this file using a text editor such as Notepad. You can also rearrange the order in which the tracks are played and change the track title information that's displayed by the MP3 player.

You can also pull some rather neat tricks with the playlist. Want the MP3 player to repeat a particular

Table 1: Where To Get MP3 Software: Rippers, Encoders & Players

Program	Web	Licence	Comments
Players			
Nullsoft Winamp	www.winamp.com	Freeware	Has graphic equaliser & playlist editor plus CDDB support. An excellent media player that's easy to use. Supports most audio formats.
Windows Media Player	www.microsoft.com	Free	Supports CDDB, can rip tracks off to WMA format & can create playlists. Includes a radio tuner so that you can listen to online radio stations. Supports most audio formats.
Sonique 1.51	www.sonique.lycos.com	Freeware	Versatile player has graphic equaliser & includes playlist edit and MP3 encoder. Supports most audio formats; lots of visual appeal.
Ripper/Encoders			
CDex 1.40 (Beta 6)	www.cdex.n3.net	Freeware	Easy-to-use ripper/encoder supports CDDB, ID3 tags & automatic playlists. Comes with a number of inbuilt encoders. Can play both MP3 and audio CD files.
Audiograbber v1.8	www.audiograbber.com-us.net/download.html	Shareware	Full-featured ripper/encoder but MP3 encoder not built-in. Trial version allows only half the tracks on a CD to be ripped.
Audiocatalyst	www.xingtech.com/mp3	Shareware	Updated version of Audiograbber with lots of options & inbuilt encoder. Interface similar to Audiograbber's but shareware version is rather limited.
Musicmatch Jukebox 6.1	www.musicmatch.com	Freeware	An excellent ripper/encoder that looks great, has all the wanted features and plays MP3s, CDs & WMA files.
MP3 Creator 1.07	www.webcelerator.com/tymp3creator.html	Freeware	Rips, encodes and plays MP3 and includes a playlist editor.
Earjam IMP	www.earjam.com	Freeware	It rips, encodes, supports CDDB & VBR and has a "cool" interface.
BladeEnc	www.bladeenc.mp3.no	Freeware	A command-line based MP3 encoder. Ideal for use with Audiograbber and other programs required an external encoder.
LAME's MP3 Encoder	www.dkutsanov.chat.ru	Freeware	Copy lame_enc.dll to the same folder as audiograbber.exe and you have a working internal MP3 encoder for Audiograbber that goes all the way up to 320kb/s. This encoder DLL is also the default for CDex and comes with that program.

track several times? That's easy – just add multiple entries of this track into the playlist.

As with many other MP3 encoders, CDex can automatically generate a playlist for you at the end of the MP3 conversion process. This creates a file called "playlist.m3u" (all playlist files have a .m3u extension) that lists all the files that you've just converted. The playlist is automatically updated if additional tracks are subsequently ripped and encoded as MP3s.

You don't have to use a text editor to edit the playlist, by the way. Some MP3 players, such as Winamp, include a playlist editor that makes the job easy. It's also possible to edit the track titles before ripping using the MP3 encoder software, as pointed out previously.

Audiograbber

Another excellent MP3 encoder is Audiograbber v1.8 – see Fig.2. This offers all the features of CDex and a few more besides, although it doesn't include an inbuilt MP3 encoder. That's easily overcome by downloading and copying LAME's freeware MP3 encoder DLL file (lame_enc.dll) to the same folder as "audiograbber.exe". You will then have an internal MP3 encoder that goes all the way to 320kb/s. Lame_enc.dll is available from www.dkutsanov.chat.ru or you can simply download and unzip CDex.zip (see panel) to obtain a copy.

Alternatively, you can use an external encoder such as BladeEnc. This is available as freeware from www.bladeenc.mp3.no – just point Audiograbber's encoder settings to the folder that contains the BladeEnc.exe file.

Unfortunately, the trial version of Audiograbber has been crippled so that you can rip only half the tracks on a CD in a single session. These tracks are randomly selected each time you insert the CD. It'll cost you $US25 for the full working version.

AudioCatalyst is essentially an updated version of Audiograbber and includes its own MP3 encoder. Once again, the trial version is crippled but $US29 restores all the features.

There are lots of other MP3 ripper/encoders available, including Earjam IMP, Easy MP3, Sonique, Easy CD-DA,

Fig.5: Winamp is a clever media player (MP3, CD audio, etc) that comes for free! Handy features include support for CDDB and a Playlist Editor (bottom).

Fig.6: want to give Winamp a different appearance from the standard fare? Easy – just download and apply a new "skin". This one is called "Spilt Milk".

Musicmatch Jukebox, Audio Converter and MP3 Creator, to name just a few.

MP3 players

You can use the Windows Media Player for playing back MP3s on your PC but our favourite is the freeware program Winamp (Fig.5). This versatile program boasts a Playlist Editor, an Equalizer, an inbuilt spectrum analyser and even a Minibrowser that lets you search web sites for MP3 files. Naturally, all the "normal" CD player controls are these, along with a volume control, a balance control and a shuffle control (oh yes, it also plays audio CDs).

You can even change the look of the graphics by downloading and applying "skins" – see Fig.6.

Using Winamp to replay MP3s is a "no-brainer" – just click the Play button and navigate to the folder where your MP3s are stored. Once there, you can either choose to play a single MP3 file or you can load a playlist (.m3u) file so that all the tracks in the playlist are played automatically.

Alternatively, double-clicking on an MP3 file or on a playlist (.msu) file automatically starts the Play function.

Clicking the little sinewave symbol at the top left of Winamp brings down a menu that also lets you Play files and launch the Playlist Editor, the Equaliser and the Minibrowser windows. These windows cleverly snap together and both the Playlist and Minibrowser windows can be resized by dragging.

The Winamp and equalizer panels can be shown

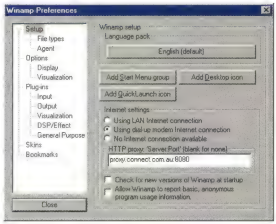


Fig.7: there are lots of easy-to-follow options when it comes to configuring your copy of Winamp.

double-size by choosing this option from the Options menu.

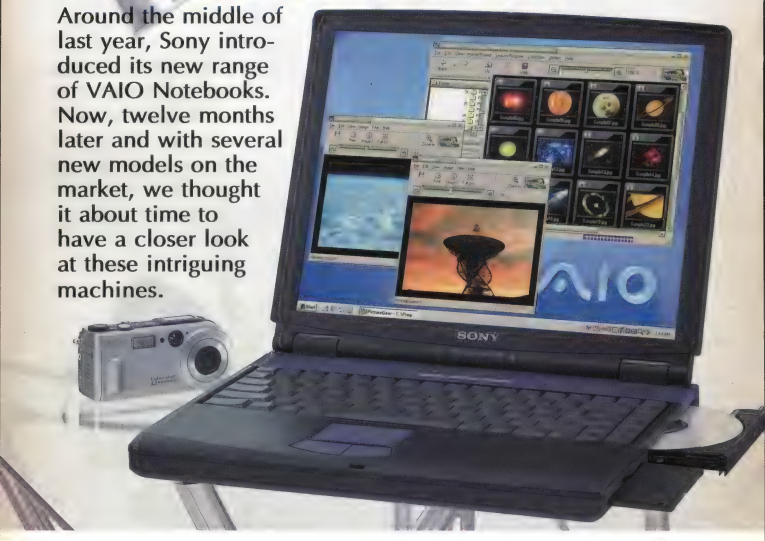
The buttons along the bottom of the Playlist Editor let you edit the entries (add, remove, sort, edit track titles and ID3 tags, and save new playlists). You can also edit the track titles and ID3 tags by right-clicking the file in the playlist and choosing the appropriate option from the menu.

Similarly, right-clicking on the Equaliser and on the Winamp player itself brings up other menu options. Really, it's a lot more complicated in the telling than in the doing and 30 minutes is all it takes to come to grips with this intuitive and clever program. **SC**

Sony's VAIO Notebooks

by Ross Tester

Around the middle of last year, Sony introduced its new range of VAIO Notebooks. Now, twelve months later and with several new models on the market, we thought it about time to have a closer look at these intriguing machines.



When Sony launched the VAIO computer range on the market, they described them as a "new concept" in personal computing.

Was this just more marketing hype, or were they really something different? And that name, VAIO: what does it mean? To the uninitiated, it sounds like some sort of pathway. But to where?

In fact VAIO is an acronym for Video Audio Integrated Operation. That in itself gives a pretty good clue as to this computer's likely application: video and audio.

In fact, that is precisely where I had my first introduction to the VAIO. During July and August last year, Sony VAIO computers were used extensively by NSW TAFE (Technical and Further Education) who were contracted by the Sydney Olympic Games Organising Committee to provide training to the 47,000 Olympics volunteers (and later the Paralympics Volunteers).

As one of those trainees, I was impressed! The standard of audio/video presentation was outstanding – an excellent mix of video and Powerpoint-style "slideshows" which were shown to groups ranging in size from just a few up to many thousands via A/V projectors.

I noticed at the time of training that name, VAIO, and wondered then what the significance of it was. It was only after the hectic period of the Games was over that I started to look a little deeper.

And then in the July issue of SILICON CHIP Jim Rowe's article on Digital

Audio Amplifiers jogged the memory ". . . have true digital audio amps, as does Sony's new Playstation 2 and its VAIO handheld computers. . ."

So we thought it might be opportune to have a closer look at one of these machines, particularly with regard to its graphics, video and sound handling capabilities. Sony were more than happy to lend us one of the models and so, before long, we were playing with a Sony VAIO FX770K.

Now this is by no means Sony's top-of-the-line VAIO but it does come with some rather impressive specs. It wasn't the graphics/video/sound oriented machine we had hoped to look at but is more a business-oriented product, albeit with pretty good performance in the graphics, video and sound areas.

Hardware

The microprocessor in this particular model is a 650MHz Mobile Intel Pentium III Processor featuring Intel SpeedStep Technology (more on this shortly), running with an Intel 815 EM chip set integrated graphics accelerator. The system bus is a standard 100MHz and it comes with 128MB of SDRAM and 32KB/256KB of cache memory (on chip).

The hard drive is 20GB, divided into two 10GB logical drives and it sports an 8x DVD-ROM drive (which obviously also plays CDs – at up to 20x). There is a single type III PC card slot (or two type II) and it supports Cardbios.

Other interfaces included are the standard 15-pin monitor, 25-pin parallel and 9-pin serial ports, plus two USB connectors, a 4-pin iLINK (IEEE 394) port and 3.5mm jacks for microphone in (mono) and headphone out (stereo). There is also an inbuilt 100 Base-T/10Base-TX Ethernet port built in.

i.LINK, by the way, is a bi-directional digital interface for exchanging data, such as digital video clips and sound files, between devices that have i.LINK connectors, or for controlling other devices.

An upgraded model, the PCG-FX770TK, also has a built-in modem for accessing the Internet, point-to-point data communication, and so on.

The floppy disk drive is removable (in fact, it is a normally supplied "option". Removing the floppy drive (a two second operation) allows its port to be used by other (optional!) devices.

From the left, the ports are USB, serial, parallel, external monitor and network (100 base-T or 10 base-T), with another USB port and DC power on the right.

Here's a close-up of the audio/video ports: the red socket is microphone, green is earphones or external (powered) speakers. Next is the i400 i-link port while the two buttons alongside release the PC-cards from their bays at right.

Software

Reflecting the machine's target business market, the operating system is Windows 2000 Professional, claimed to be the most stable Windows operating system yet. Some might argue that point!

Other software included with the machine is DVgate 2.2, Movie-Shaker 2.0, Sony Notebook Setup, Picture-Gear 5.0, Smart Capture 4.1, OpenMG Jukebox 2.0, Smart Connect 3.0, Smart Connect Monitor 1.0, DVD Region Setting Utility, Adobe Acrobat Reader 4.0, Adobe Premiere 5.1LE, Quick-Time 4.1, Real Player 7 Basic, McAfee VirusScan and WinDVD 2000.

LCD and keyboard

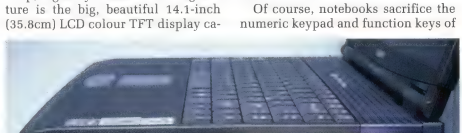
On opening the VAIO and powering it up, arguably the most striking feature is the big, beautiful 14.1-inch (35.8cm) LCD colour TFT display capable of XGA (1024 x 768) resolution. Because it's LCD, you tend to view this screen closer than you would a typical CRT monitor. It is very clear and crisp and even after extended use I didn't find it at all tiring.

Of course, you *could* plug in an external monitor and get up to 1400 x 1050 resolution.

One of the common misconceptions about notebook computers is the size of their keyboards. Many people think that they are smaller than standard desktop keyboards but, with very few exceptions, they are the same size (they have to be, otherwise you'd make too many typing mistakes!).

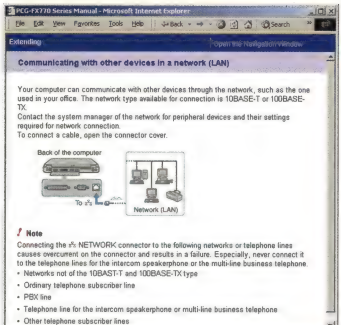
If you don't believe us, measure, say, the numeral keys from 1 to 0 on your computer keyboard. From outside edge to outside edge, I'll bet it's around 185mm. On the Sony, as on most notebooks – 185mm!

Of course, notebooks sacrifice the numeric keypad and function keys of



The other side of the case has the removable floppy disk drive (left) and the DVD player at right, shown here partially open. The touch-pad "mouse" can also be seen in this shot (middle left). The pad on the right is the touch-sensitive one while the two pads below it simulate left and right mouse buttons.

Some of the "help" files are, in my humble opinion, woefully inadequate. Here is the information you get on how to connect the computer to your network – basically, all it says is "plug it in". For any more help you are supposed to contact the system manager of the network. What if you don't have one? By the way, Sony are not alone here: help is becoming less and less helpful amongst most hardware and software!



desktop keyboards. For those who want a "numeric" keypad (eg, for fast data entry), the Sony places it on the M, JKL, UIO and 789 keys, activated by the "num lk" key. The various function keys are located on three sides of the alpha/numeric keys – it doesn't take very long at all to get used to their locations.

The normal mouse is replaced by a touch-sensitive pad. Draw your finger over the pad and the on-screen cursor follows the movement. Two large switch pads underneath the touch pad simulate the left and right mouse buttons. It takes a bit of getting used to when you've used a mouse for twenty years (especially on drop-down menus!!!) but in time, I believe it could be quite enjoyable.

Sony is fairly noncommital about the type of graphics firmware – the spec simply says "hi-speed graphic accelerator". It is based on Intel's 815EM integrated chipset. In this particular VAIO there is no separate video memory – it shares up to 11MB with the main memory.

The audio system is Windows Sound System compatible, AC97 compliant and features a software MIDI sound generator, 3D sound function and has the previously mentioned digital amplifier with a pair of inbuilt speakers.

On this point, we have to be somewhat critical: we believe one of the main uses for a machine such as this is on-the-job presentations – say, for example, an advertising agency wanting to present a new campaign to a client. The audio simply isn't loud enough! And even with 'phones plugged in, you could hardly describe it as mind-blowing. A pair of amplified speakers would solve the problem – but that's something else to carry around.

Incidentally, audio level, screen brightness and other functions are all controlled via the keyboard: audio, for example, is a "Fn" and F4 key combination, followed by right or left arrows to increase or decrease the volume (mimicked by an on-screen icon).

Having the inbuilt network adaptor was a joy – I wanted to transfer some files from my office PC to the notebook and vice versa – it was simply a matter of plugging the Sony in, setting a few parameters and it talked to the network with no worries.

I didn't get a chance to fire up any USB devices, mainly because I didn't have a suitable cable on hand. But with two USB ports included, the Sony VAIO would have no problems communicating with other USB devices.

Dual speed

One interesting feature of this particular notebook, which uses Intel's "Speedstep" technology, is its automatic changeover to a lower-power mode on battery. With the AC adaptor plugged in, the machine operates at its maximum 650MHz. But if you unplug power, the screen automatically dims and the machine switches to "battery optimized performance", dropping the CPU speed down to 500MHz.

The battery is a 14.8V/1700mAh Li-ion type which can be swapped over. Incidentally, a fully-charged battery is rated to last 1.5 to 2.5 hours, depending on usage.

The computer has an automatic "hibernate" mode when the battery is nearly exhausted, saving current work and settings to the hard disk drive before effectively turning itself off. From this point, nothing is lost when either the battery is recharged or the computer is run on AC. It also has a "standby" mode which shuts down most functions to save power (for example, if you are taking a break) but if the battery discharges completely in this mode, current work and settings would be lost.

The AC adaptor is universal – 100 to 240V 50/60Hz so you can take it virtually anywhere in the world.

Three so-called "power" keys above the keyboard allow instant (well, almost) connection to the Internet, to email (both assuming an external modem is connected) and also to go into standby mode, as mentioned above. Each of these keys is programmable to do other tasks if you wish.

In use

The VAIO PCG-FX770K is not the best performing machine in the range from a graphics and video handling point of view. It is obviously not intended to be – there are significantly more expensive VAIO models which are aimed squarely at that market.

So we didn't get the opportunity to run the VAIO through all the modes we would have liked. Instead, we used it in the mode intended – as a business computer with advanced video/audio capabilities.

We've already criticised the audio level; no doubt, though, the vast majority of users would link this to an A/V projector so would not find that a problem. And as far as video goes, we've already commented on the beautifully clear, crisp screen. We ran the "Fantastia 2000" DVD as a test and the machine acquitted itself very well indeed – no dropouts, no freezes, no problems.

The Sony is capable of playing DVDs from any region – up to a point. The DVD Region Setting Utility will allow you to change the region a few times – they don't actually say how many – but once this limit is reached the machine is locked – permanently – on this region. Bad luck if you want to watch a Region 1 DVD and that's your last

change – you'll never be able to watch a region 4 (ie, Australian) DVD again.

What's the betting there will be a "crack" on the Internet soon for this little feature?

We also loaded and ran a few applications which this type of machine would lend itself to. One program which very quickly sorts out the men from the boys, as far as operation goes, is Photoshop. While the screen re-writes weren't as quick as we were used to with a comparable speed desktop computer, they were adequate – and the quality was excellent. In fact, I did some high-level photo manipulation using the VAIO then transferred the file to my desktop computer to compare results: there was nothing to pick between them. Colour accuracy was superb.

As you might expect with 128MB of memory and a 20GB hard disk, there was precious little difference in "ordinary" applications such as Word or Pagemaker. But with the big advantage of go-anywhere performance, the VAIO has a definite edge.

The "manual"

A somewhat abridged operating manual is supplied – basically, it's just a getting started and trouble-shooting guide. The "real" manual is pre-loaded onto the computer's hard disk. It's a trend being followed by more and more manufacturers these days (printed manuals are expensive) but, speaking purely from a personal perspective, they are less satisfying than a "real" manual.

It's more of this push to make everything resemble web pages. Sure, you can almost instantly log on to the manual and look up what you want in the index. But I'd much rather have something I can read over and over in my hot little hand (OK, so I'm a slow learner). And the quality and quantity of the information leaves a little to be desired, too: for example, on the underside of the machine are at least three expansion sockets. Try as I might, I couldn't find any reference to them or what they were for.

Perhaps Sony intends them for factory options only. Well, they should say so – or at least explain what they are for.

And another: there's a section on connecting to a LAN via the Ethernet connector. I've reproduced the page to show the wealth (!) of information given. It's typical – I would have expected much more.

The verdict?

At an rrp of $3799, the Sony VAIO PCG-FX770K does represent very good value for money, even with the limitations we've described. With 850MHz processor, 128MB of member and 20GB of hard disk drive to play with it's going to handle most of the work you can throw at it and you won't tire viewing that beautiful big LCD screen. The software supplied will more than get you started in audio and video.

If you want more features, you're going to have to spend more: the just-released FX-880K, for example, has a PIII 850MHz processor, a 15-inch TFT LCD screen, an inbuilt modem and all the bells and whistles of the FX770K – and costs $4699. Even more upmarket is the PCGR505 with a $5899 tag – but that includes a docking station.

Anyway, that's the Sony VAIO FX770K – in many ways exciting, in some ways disappointing. But overall the pluses far outweigh the minuses. The biggest minus of all: Sony have just called, asking for it back . . . spoilsports! **SC**

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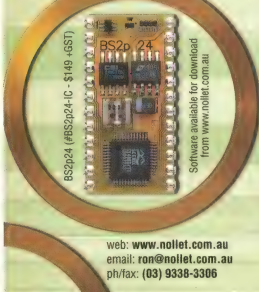
```
I2COUT 0, $A0, 5, [100]
```



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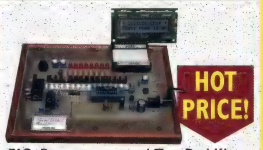

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Build your own MP3 Jukebox

Want to impress your friends? Build this neat little project to control your PC's MP3 player remotely! Alternatively, if you're interested in adding remote control and/or LCD readout to an existing project, read on!

Part 1:
By PETER SMITH

OVER THE COMING months, we will describe how you can transform your PC into a veritable jukebox, able to play any of your favourite MP3s at the press of a button. And if you're really serious about your MP3 music, you can even build a standalone PC-based player without a monitor or keyboard.

We've received so many requests for MP3 projects that we just couldn't ignore them. This project includes the most-requested features but omits some of the more radical – such as a Pentium III PC strapped in the car boot with a custom power supply, up-front console and remote control!

What will the finished project do, exactly?

Essentially, we've taken one of the most popular freeware music players on the Internet, Winamp, and added some software to allow it to be controlled remotely.

IR Remote Receiver & Display Features

- Works with most off-the-shelf universal remote controls
- 16 character, 2-line LCD with backlighting
- Simple serial interface
- In-built mini-terminal makes programming easy
- Microcontroller (IC1) can be programmed in-circuit
- No messy wiring

Next, we designed a small board to do the remote bit. It receives codes from any universal remote control and also provides an LCD readout big enough for MP3 track data. Plug it into a free serial port on your PC (or even build it right into your PC) and you've got a mean MP3 machine!

This month, we describe the hardware part of the project. Next month, we'll look at the Windows-based software, including Winamp and the control software that makes it all work as an MP3 player.

The hardware – it ain't hard!

The brains of our little project is an AT90S2313 microcontroller chip from Atmel. We've chosen this particular microcontroller because it has plenty

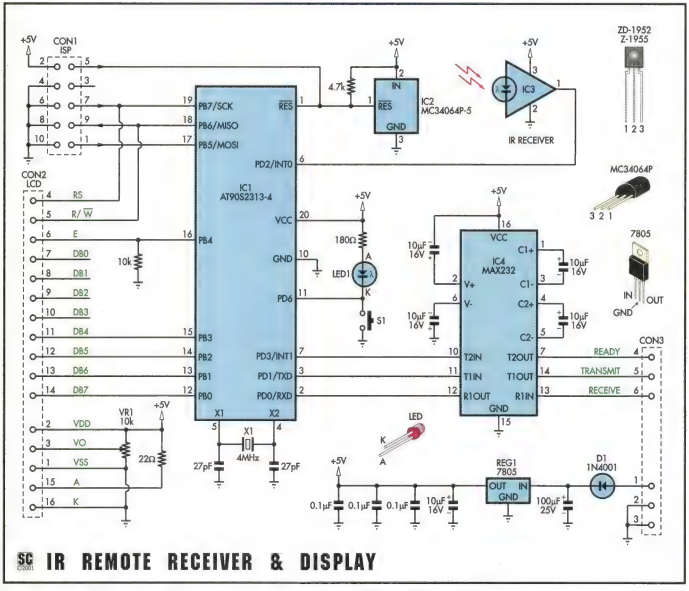


Fig.1: an Atmel AT90S2313-4P microcontroller (IC1) does most of the work in the circuit. It outputs control signals to a MAX232 RS232 receiver/driver IC (IC4), which in turn driver the serial port of your PC. IC3 is the IR receiver chip.

HIGH NIBBLE (D7-D4) OF CHARACTER CODE (HEXADECIMAL)

LOW NIBBLE (D3-D0) OF CHARACTER CODE (HEXADECIMAL)	0000 (0)	0010 (2)	0011 (3)	0100 (4)	0101 (5)	0110 (6)	0111 (7)	1010 (A)	1011 (B)	1100 (C)	1101 (D)	1110 (E)	1111 (F)
xxxx0000 (0)	CG RAM (1)												
xxxx0001 (1)	(2)												
xxxx0010 (2)	(3)												
xxxx0011 (3)	(4)												
xxxx0100 (4)	(5)												
xxx0101 (5)	(6)												
xxx0110 (6)	(7)												
xxxx0111 (7)	(8)												
xxxx1000 (8)	(1)												
xxxx1001 (9)	(2)												
xxxx1010 (A)	(3)												
xxxx1011 (B)	(4)												
xxxx1100 (C)	(5)												
xxxx1101 (D)	(6)												
xxxx1110 (E)	(7)												
xxxx1111 (F)	(8)												

Table.1: all the characters that can be displayed by the LCD module, along with their respective ASCII codes.

of memory and runs fast enough to be able to handle all the tasks that we've thrown at it.

What's a microcontroller? Put simply, it's a microcomputer integrated with a bunch of useful devices that makes interfacing to things like our LCD and infrared receiver really easy.

In short, the microcontroller connects the LCD and infrared receiver to the outside world via a simple 4-wire serial interface. For our MP3 Jukebox project, the outside world is the serial port on a PC but it could just as easily be any microcontroller or computer project (see our Basic Stamp example later).

The whole lot fits on a PC board not much bigger than the LCD module itself and is easily mounted behind any flat panel. As you can see from our photos, we've mounted ours behind a drive-bay blanking plate on a standard ATX PC computer case.

So what can it do? Well, let's look at the display part first.

The liquid crystal display

The display part functions as a simple serial terminal, meaning that characters received from the serial input are displayed on the LCD.

In addition to displaying the usual ASCII characters (listed in Table 1), the program (or firmware) in the microcontroller allows our little board to recognise a number of "control" codes.

If you've worked with ASCII before, you'll know that the first 32 bytes of the character set are used as "control" codes – they're not displayable and are intended solely for, strangely enough, control purposes.

Using control codes, the programmer can change the cursor type, position the cursor, clear the display, and so forth. Table 2 lists all the control codes our project supports.

Two codes in the table require further explanation. The first is the cursor positioning code, Ctrl-P. Unlike other control codes that are just one byte in length, to set the cursor position you need to send two bytes – Ctrl-P (16) followed by the required position (0 = first position of first line, 31 = last position of second line) plus an offset of 64. For example, to position the cursor at the beginning of the second line, you would send 16 and then 80 (16 + 64).

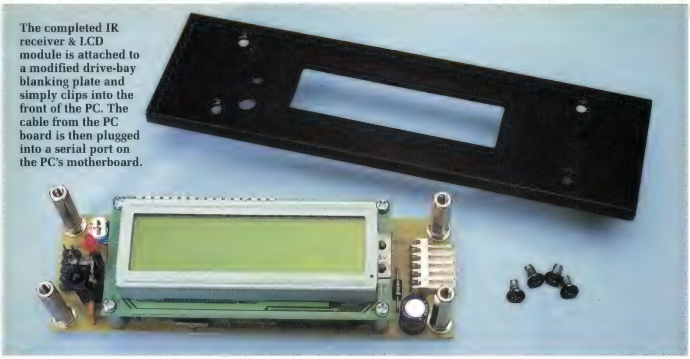
The second code of interest is Ctrl-[, also known as "escape". This code is used as the prefix for functions that require more than a single byte. Typically, a character identifying the function, then one or more characters containing the relevant parameters follows the escape code. This is known as an escape sequence.

Our project defines just one escape sequence, which we've used to program the custom LCD characters – we'll look at how these work a little later.

The IR receiver

This project differs from past infrared remote control projects described in SILICON CHIP in that it doesn't require a purpose-built transmitter. It works with most off-the-shelf universal transmitters, like the one you're probably already using with your TV and VCR!

Why do we need a different remote control for every new piece of equipment we buy anyway? Simply because there is no single remote control standard in use for consumer equipment. Many households have at least two (usually more) remote controls, while



The completed IR receiver & LCD module is attached to a modified drive-bay blanking plate and simply clips into the front of the PC. The cable from the PC board is then plugged into a serial port on the PC's motherboard.

some have opted for a "universal" unit that can be set up to work with equipment from different manufacturers.

Naturally, we chose a "standard" that is probably supported by all universal remotes. This is the RC5 system, developed by Philips and in wide use throughout Europe. If you want to know a little about the workings of the RC5 system, then refer to the accompanying panel: "The RC5 Remote Control Specification".

To prove our system, we obtained two completely different universal remotes; one from Jaycar Electronics (model BC-3000, Cat AR-1710) and one from Coles Supermarket (Remote Master brand). When selecting a remote, you need to make sure that it has all the keys you would typically use to control a VCR or CD player (play, fast-forward, rewind, etc), as these aren't included on the simpler TV-only models.

Another important consideration is the number and type of devices it can control. If you only intend to use the remote for this project, then all you need is support for "VCR" or "CD" control.

If, however, you want to use the same remote for other equipment, then you need to make sure that it will accommodate all intended devices. Our MP3 player can masquerade as a VCR or CD player, so in most cases you will be able to work it in with what you already have. An exception to this would be if you already have a Philips brand VCR and a Philips brand CD player – a fairly unlikely (and in our case, unlucky) situation.

To reliably receive data from one of these infrared transmitters, we need quite a bit of electronics, specifically an IR diode, amplifier, limiter, bandpass filter and demodulator. Thankfully, all of these circuits are available in a single IC package. Jaycar Electronics has just what we are looking for in their ZD-1952 IR receiver IC, while Dick Smith Electronics has the Z1955.

The output from this IC is the recovered digital signal, which we pipe directly into the microcontroller chip for decoding.

After successfully decoding, the microcontroller flashes the "received" LED and sends the codes out the serial transmit line. To maintain data integrity, the codes are packaged with a couple of extra bytes, as follows:

Byte 1 – Start byte (254)
Byte 2 – Control bit (bit 7) + System address (bits 4-0)
Byte 3 – Command (bits 5-0)
Byte 4 – Checksum of bytes 2 & 3

The start byte serves as a simple synchroniser, indicating the start of incoming data. The second and third bytes are the expected address and

Table 2: Display Control Codes

Code	ASCII	HEX	Function
Ctrl-@	00	00	Null (ignored)
Ctrl-A	01	01	Home cursor
Ctrl-D	04	04	Hide cursor
Ctrl-E	05	05	Underline cursor
Ctrl-F	06	06	Blinking block cursor
Ctrl-H	08	08	Backspace
Ctrl-I	09	09	Horizontal tab
Ctrl-J	10	0A	Linefeed (cursor down one line)
Ctrl-K	11	0B	Vertical tab (cursor up one line)
Ctrl-L	12	0C	Formfeed (clear screen)
Ctrl-M	13	0D	Carriage return (cursor to start of line)
Ctrl-P	16	10	Set cursor position
Ctrl-S	19	13	Auto-scroll on
Ctrl-T	20	14	Auto-scroll off
Ctrl-[	27	1E	Escape (start of multi-byte instruction)

command codes. The fourth byte allows simple verification of the previous two bytes. If bytes 2, 3 and 4 are added together (modulus 256), then the result should always be zero.

Construction

A number of components in this project are static sensitive and should be treated accordingly. This applies particularly to the LCD module and IC1, the microcontroller. Wear a properly earthed anti-static wrist strap and use a soldering iron with an earthed tip during the following steps.

All parts, including the LCD module, are mounted on a single PC board measuring 115 x 36mm. Referring to the overlay diagram (Fig.2), begin by installing the 9 tinned copper wire links, taking care to keep the links as straight as possible, as many of them will pass quite close to component leads. Next, install all the resistors, diode D1, and then the socket for IC1.

The crystal (X1) can be installed next. Its leads should be bent at 90° about 2mm from the body so that they slip easily into their holes with the package lying flat against the PC board. Before soldering, make sure that you can just see the hole in the PC board at the top edge of the crystal. You need to use a short length of tinned copper wire to solder the body of the crystal to the pad underneath at this point.

Next, install IC2, S1, VR1, CON1 & CON3. Note: CON1 is optional; it isn't needed if you have a pre-programmed microcontroller (IC1).

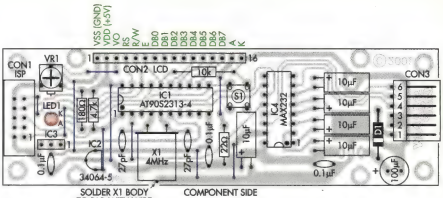


Fig.2: the assembly details for the PC board. The body of the crystal (X1) is anchored to an earth track on the board using tinned copper wire.

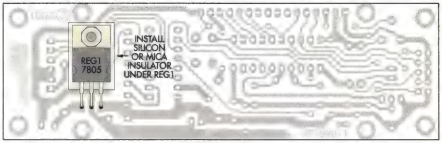


Fig.3: install the 5V regulator on the copper side of the board, as shown here (see also Fig.5).

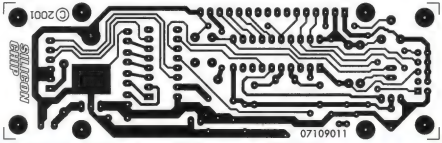
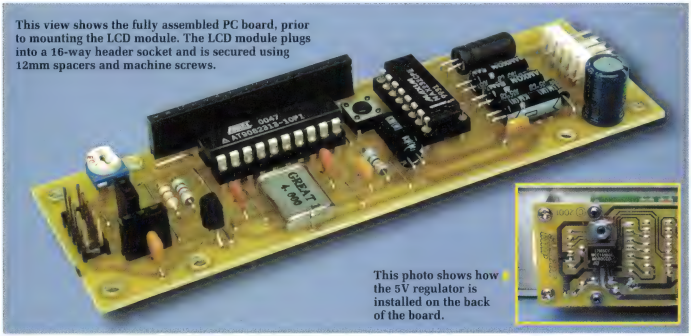


Fig.4: this is the full-size etching pattern for the PC board.



Now flip the board over and install REG1 on the copper side, following the mounting details shown in Fig.5. The insulator is necessary to prevent the tab of the regulator shorting out the tracks that pass underneath. Solder the regulator's leads and flip the board over again. You will note that the regulator's leads protrude through the top (component) side – cut these off flush with the surface of the board.

Now we can install all the capacitors. Take special care with the five 10µF electrolytic capacitors. As you can see from the photos, they need to have their leads bent at 90° (about 2mm from the body) so that they lie flat against the PC board. These are polarised components – it is important which "way around" they're installed, and getting it wrong on this board is dead easy!

CON2 and the sockets for LED1 and IC3 can be installed next. We've socketed both LED1 and IC3 using part of the 40-pin single row header socket, so begin by cutting down the header socket into one 16-pin length, one 3-pin length and one 2-pin length. Use a sharp utility knife, and watch the pinkies!

Install your newly-fashioned sockets into their respective positions, making sure that they are seated squarely against the PC board before soldering. We won't plug in LED1 or IC3 just yet, because we need to fit the LCD module first to get height measurements.

Note that we haven't installed IC1 or IC4 yet either (tempting, isn't it?). We need to apply power first and check that the +5V rail is OK. To do this, you'll need to make up the power/data cable, using Fig.6 as a guide.

Hook up the cable and apply power. If you don't want to power the unit from your PC just yet, then any DC power source capable of supplying between about 8-12V DC at 100mA will do the job. Using a digital multimeter, measure between pins 10 and 20 of the IC1 socket. You meter should read 5V ±0.25V. If all is OK, remove power and install IC1 and IC4.

Mounting the LCD module.

Now we're making progress! First, we need to install the header pins along the top edge of the LCD module. It's important that the pins are inserted on the correct side of the board (see photos) – once they're soldered in, they're very difficult to remove!

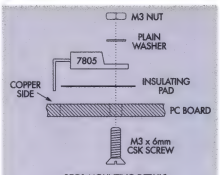


Fig.5: the mounting details for the 7805 regulator. It must be isolated from the copper on the PC board using an insulating pad.

Using side-cutters or a sharp knife, separate a 16-pin section (for modules with backlighting) or 14-pin section (for modules without backlighting) from the 40-pin single row header. Insert it on the bottom side of the LCD module and solder on the top (display) side. Ensure that the entire row of pins is seated squarely (sitting at 90° to the PC board) before soldering.

Now plug the module into CON2 and secure to the main PC board with the four 12mm untapped spacers and M2.5 screws and nuts. You will note that the header doesn't quite go all the way home – it sits about 1mm proud of the socket edge. This is perfectly acceptable, as the socket contacts have already done their job. Don't fit washers under the nuts or screw heads, as they may short out nearby tracks.

By the way, we've specified a particular LCD module from Dick Smith Electronics as not all modules have identical mounting hole or connector positions. In other words, you may have difficulties if you try to fit a module from a different source.

The final step is installing LED1 and IC3, the IR receiver chip. As you can see from the photos, we have not plugged these components directly into their sockets. Rather, to ensure reliable mating to the socket contacts, we've soldered them to header pins first.

Separate one 2-pin length and one 3-pin length from the remaining portion of the single row header for the LED and IR receiver. Before soldering them to the header pins, you might find it easier to prepare the front panel first so that you can accurately determine how much lead length will be required.

Bolting it up

An easy way to get everything to fit nicely up front is to photocopy the template in Fig.7, cut it out and tape it on to the panel. Use a sharp knife to mark the display cutout outline, and a centre punch to mark the hole positions for drilling.

Four long spacers are used to mount the assembly behind the panel, so lets fit these next. Slip an M3 x 10mm screw into one of the corner holes on the PC board from the copper side. If your LCD module has backlighting, it is 4.5mm "thicker" than ones that don't, so install two M3 washers and an M3 nut to provide extra mounting depth. Finish with a 20mm tapped spacer and then repeat the above for

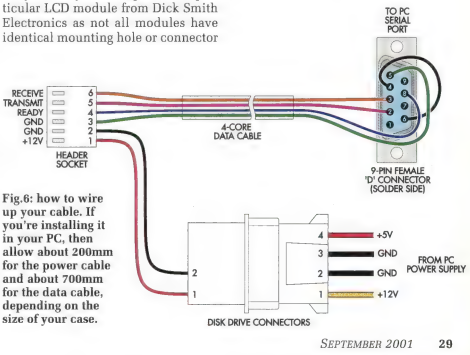


Fig.6: how to wire up your cable. If you're installing it in your PC, then allow about 200mm for the power cable and about 700mm for the data cable, depending on the size of your case.

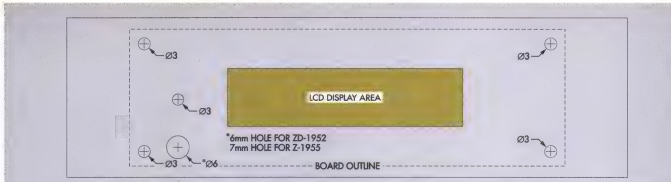


Fig.7: the is the drilling and cutting template for the drive-bay blanking plate. Note that the two IR sensors specified in the parts list require different hole sizes.

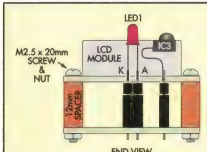


Fig.8: this drawing shows how the LCD module is mounted. Note how the leads of the IR receiver (IC3) are bent, so that it fits neatly against the front panel. Make sure that the LED leads cannot come into contact with the IR receiver leads.

	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0	BYTE PATTERN BINARY	DECIMAL
BYTE 0						00000000	0
BYTE 1			■			00000100	4
BYTE 2		■				00001000	8
BYTE 3	■	■	■	■	■	00011111	31
BYTE 4		■				00001000	8
BYTE 5			■			00000100	4
BYTE 6						00000000	0
BYTE 7						00000000	0

Fig.9: the LCD module has eight user-definable characters. Each pixel row translates to one byte, with a total of eight bytes required to define one character. Here we show how a "left arrow" character might be defined.

the other three corners.

Invert the works on a flat surface (LCD module and spacers facing down) and check that no light is visible between the end of the spacers and the flat surface. In other words, the spacers should be equal to or slightly higher than the surface of the LCD module. If not, then add washers as necessary. This is important because no pressure should be applied to the front of the LCD module when the assembly is bolted home.

With the assembly complete, you can trial-fit it to the front panel in order to gauge the length of the LED and IR receiver leads. The LED leads need to be long enough so that it protrudes through the panel, but not so long that its shoulder contacts the inside of the panel surface when installed.

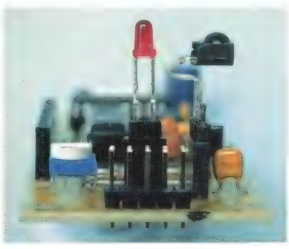
The IR receiver needs to be bent over at 90°, with its main body mass flush with the inside panel surface. Fig.8 shows how this is done. Take your time with this step, as it's easy to overstress the leads. The IR lens (the "bump") should actually slip inside the hole that you've drilled in the panel, with plenty of clearance all round. Once you're satisfied, trim to size and solder to the header pins.

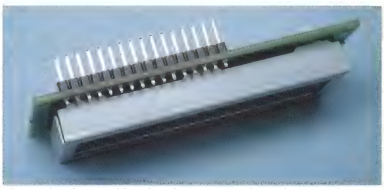
Testing the LCD display

Hook up the cable to a free serial port on your PC and connect a suitable power source. If you've made the cable as per our diagram, then obviously you'll need access to an unused disk drive power connector from inside the PC case.

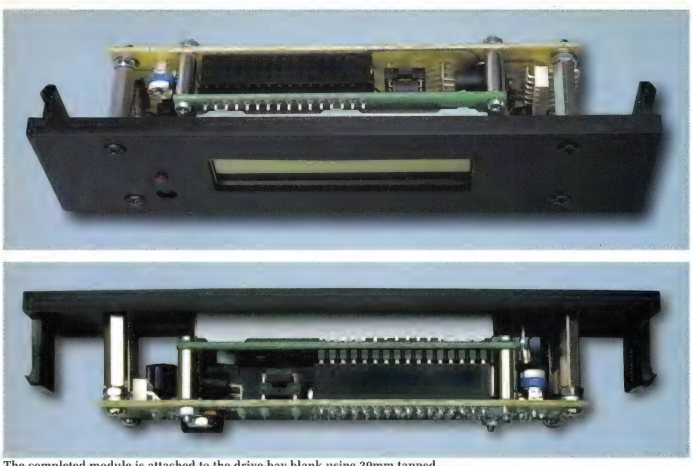
If all your PC's power connectors are already in use, you can purchase a "splitter" cable to fix the problem. These are available from DSE (cat X-2604), Jaycar (cat PL-0750) and most other computer suppliers.

I'm assuming you're running Windows 95, 98, ME, NT or 2000, and that





The pin header is soldered to the LCD module as shown in the above photograph. The photo at left shows how the LED and IR receiver are mounted on header pins on the main board and plugged into matching header sockets.



The completed module is attached to the drive-bay blank using 20mm tapped spacers plus extra M3 nuts and washers as necessary to ensure that the LCD sits flush with the front panel cutout. The drive-bay blanks were resprayed black and the computer case charcoal grey with yellow highlights, to improve the appearance.

you have HyperTerminal installed. If you don't have HyperTerminal installed, then you can install it from the original Windows CD via Control Panel -> Add/Remove Programs -> Windows Setup. You'll find it in the "Communications" group.

When you start HyperTerminal, you'll be prompted for a name for the new connection. Enter whatever you like and click OK. The *Connect to* dialog box now appears. Click the down-arrow next to the *Connect using* box and select the appropriate COM port, then click OK. The COM port settings dialog appears next. The settings you require are as follows:

Bits per second: 9600
Data bits: 8
Parity: None
Stop bits: 1
Flow control: Hardware

Now click on the OK button and you're ready to go.

As soon as power is applied, the start-up message "SILICON CHIP" should be displayed and you will be able to see the glow of the LED backlighting. Characters that you type on the keyboard should appear verbatim on the display. You can also experiment with the various control codes. For example, to clear the display, hold down 'Ctrl' and press 'L'.

Testing the IR receiver

Before you can test the IR receiver, you need to set up your remote control to suit. Universal remote controls are supplied with a long list of all the brands and types of equipment they support. For our application, you should select only "Philips" as the brand and either "VCR" or "CD" for the equipment type. You'll probably find that more than one code is listed against each choice, with no further explanation. All you can do is try each code in the list until you find one that works.

Following the supplied instructions, lock in the chosen code and then press the appropriate equipment button. For example, if you chose "VCR", don't forget to press the VCR button before proceeding!

We found that VCR code 278 works well with the Jaycar BC-3000, while for the Remote Master we chose CD code 1065 (use device mode AUX).

You'll know you've found a code that works when you point the remote at the IR receiver, press a button (try a digit first) and the LED flashes in response. If you still have the serial connection active, you'll note that "garbage" characters appear in the HyperTerminal window whenever you press a key on the remote. This is a great sign – it means that all is working to plan!

What if it doesn't work?

In all cases, recheck the +5V supply rail. Next, check that the microcontroller's reset signal on pin 1 is at a logic high (close to 5V) and if you have an oscilloscope, check that the crystal oscillator is oscillating.

Does the LCD display a message at power on? If not, check for shorts between pins at CON2 and using the circuit and overlay diagrams as a reference, do a continuity test between the pins on the LCD and the associated pins on the microcontroller.

Listing 1

```
'{$STAMP BS1}
symbol S_IN = 6                 'serial data input pin
symbol S_OUT = 7                'serial data output pin
symbol SYS_CODE = B0            'save system code here
symbol CMD_CODE = B1            'save command code here
pause 500                       'wait for display to initialise
' Clear LCD screen and display message
serout S_OUT,N2400,(12,"IR Receive Test")
loop:
' Wait until start of record received ($FE), then save next 2 bytes
serin S_IN,N2400,($FE),SYS_CODE,CMD_CODE
' Display the received IR codes on the LCD
serout S_OUT,N2400,(12,"Sys Code = ",#SYS_CODE)
serout S_OUT,N2400,(10,13,"Cmd Code = ",#CMD_CODE)
goto loop
```

Listing 2

```
DEFINT A-Z
CLS : PRINT
PRINT "Custom character demo for Silicon Chip LCD Display"
' Set up COM port (change COMx number to suit your system).
OPEN "COM2:9600,N,8,1,CD0,CS0,DS0,OP0" FOR OUTPUT AS #1
' Write the bit patterns (from the DATA statements below)
' into the LCD's CG RAM.
FOR Char = 0 TO 2               'define custom chars 0, 1 & 2
CharNum$ = LTRIM$(RTRIM$(STR$(Char))) 'trim off Qbasic's spaces
PRINT #1, CHR$(27); "D"; CharNum$;  'send ESC D and character number
FOR Row = 1 TO 8                'each char. consists of 8 rows
READ CharBits                   'get next bit pattern from data
PRINT #1, CHR$(CharBits);       'write to LCD
NEXT Row                        'do all 8 rows for this character
NEXT Char                       'do next character
PRINT #1, CHR$(12); "NEW CHARACTERS:"
PRINT #1, CHR$(16); CHR$(16 + 64);  'cursor to start of second line
PRINT #1, CHR$(0 + 128); CHR$(1 + 128); CHR$(2 + 128) 'show custom
' Custom character bit patterns follow.
' OK symbol
DATA 8,20,20,8,5,6,5,5
' locked symbol
DATA 14,17,17,31,27,27,31,0
' unlocked symbol
DATA 14,16,16,31,27,27,31,0
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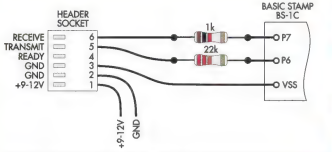


Fig.10: this project is eminently suitable as an add-on to a variety of other micro projects. Here's how to wire it up to the Basic Stamp-1C. This model Stamp doesn't have a true RS232 serial interface, so the resistors are included to provide protection for the I/O port pins. (The Basic Stamp-1C is available from Dick Smith Electronics).

If the LCD appears to be working but characters are not displayed when you type in HyperTerminal, then you can do a complete line loopback that will verify your cable as well as the RS232 receiver/transmitter chip (IC4). To do this, remove the LCD, unplug the microcontroller (IC1) and insert a fine wire link between pins 2 & 3 of the microcontroller socket and another link between pins 7 & 10. Leave out the LCD module (and IC1, of course!) and apply power.

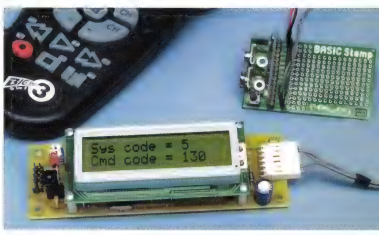
Now any keys you type should be looped right back and displayed in the HyperTerminal window.

So the display and serial input works but the IR receiver doesn't? First, check that the LED lights when you press the switch (S1). Next, check that you have installed the receiver chip (IC3) correctly, with pin 1 aligned as shown on the circuit and overlay diagrams (and photos). The output from this chip is idle high, going low when infrared light modulated around the 38kHz mark is received. If possible, try a different remote control, set up as detailed above.

Got other uses in mind?

Although this project is intended for our MP3 Jukebox, it would be equally at home as an extension to just about any computer or microcontroller project that requires an intelligent serial LCD readout and/or an IR receiver.

Perhaps an example is in order. Fig.10 shows how to connect up to a Basic Stamp 1. Listing 1 shows just how easy it is to drive, even with the Basic Stamp's limited resources. This short program waits for a key press on the remote and then writes the received system and command bytes back to the LCD – an easy way to



The RC5 Remote Control Specification

HAVE YOU EVER wondered how it is possible to control multiple pieces of equipment in the same room with just one remote? Well, all remote control systems that we know of use a method of addressing that separates equipment into generic groups. TVs, VCRs and CD players, for example, represent three such groups.

In the RC5 specification, there are a total of 32 addressable groups, each with 64 possible commands. If you do the sums, this means that 2048 unique commands (or "messages") are supported.

Each message in the RC5 coding method is composed of a 14-bit serial stream. A message consists of four parts:

- Start part – 1.5 bits (2 x logic "1")
- Control part – 1 bit
- System part – 5 bits
- Command part – 6 bits

The start bits give the receiver AGC time to "lock on" to the incoming data. The control bit, also called the toggle bit, is simply a flag to indicate whether the following code is new or repeated. If a new key is pressed, the control bit toggles (changes state) from it's previous value, otherwise it remains the same. The system bits are the equipment address, as described above. Finally, the command bits are the code for the actual key pressed.

Table 3 lists all of the equipment addresses. Table 4 lists just a few of the possible 64 commands and the key functions that they relate to. Determining the code transmitted for any key on your remote is very easy, as we will see in our software examples.

On the physical level, data is transmitted using bi-phase (also known as Manchester) encoding. A logic one is represented by a zero-to-one transition at 1/2-bit time, whereas a logic zero is represented by a one-to-zero transition. One-bit time is approx. 1.778ms, so a complete message is 24.889ms long, with messages repeated at a minimum of 114ms intervals.

To reduce interference from other light sources, data is transmitted on a 36kHz carrier. We found that the Jaycar ZD-1952 infrared receiver IC worked well with a number of different remote controls that we tried, even though its centre frequency is specified as 37.9kHz.

Table 3: RC5 Equipment Addresses

Address	Equipment
0	TV1
1	TV2
2	Videotext
3	TV1 & TV2 expansion
4	Laser video player
5	VCR1
6	VCR2
7	Reserved
8	SAT1
9	VCR1 & VCR2 expansion
10	SAT2
11	Reserved
12	CD video
13	Reserved
14	CD photo
15	Reserved
16	Audio preamp 1
17	Tuner
18	Cassette recorder
19	Audio preamp 2
20	CD
21	Audio rack
22	Audio satellite receiver
23	DCC recorder
24	Reserved
25	Reserved
26	Writable CD
27-31	Reserved

Table 4: RC5 Keycodes & Functions

Code	Function
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10+
12	Standby
13	Mute
16	Volume -
17	Volume +
32	Ch/prog +
33	Ch/prog -
35	20+
39	Tint/hue +
48	Pause
50	Rewind
52	Fast-forward
53	Play
54	Stop
55	Record

check the codes assigned to each key on the remote.

Advanced features

The default baud rate is 9600 bits/sec, but can be changed to either 4800 or 2400 by entering setup mode. To enter setup mode, press and hold down switch S1, then apply power, releasing the switch when the start-up message appears. Immediately the switch is released, a message appears displaying the firmware revision, followed by the prompt "Set baud rate?". If you press the switch again within four seconds, the current baud rate is displayed. You can then cycle through all three possible baud rate values in turn, until you find the one that you require. If you don't press the switch within four seconds, then the display clears and the last value displayed becomes the new baud rate. Don't worry if you weren't quick enough the first time; just repeat the procedure!

If you don't press the switch at the "Set baud rate?" prompt, then "Download EEPROM?" appears after a few seconds. If you press the switch at this point, the message changes to "Waiting for data". As you might have deduced from the message, this feature allows you to update the contents of the microcontroller's EEPROM. In order to make use of this feature, you need at least a little knowledge of microcontroller programming.

The AT90S2323 has 128 bytes of EEPROM and our firmware makes use

Parts List For IR Remote Receiver + LCD Display

1 PC board, code 07109011, 115 x 36mm
1 LCD module, 16 character x 2 line with LED backlight* (DSE Cat Z-4172) **-OR-**
1 LCD module, 16 character x 2 line (DSE Cat Z-4170). * Note: LCD module with backlighting recommended
1 10-pin dual row header (CON 1) (optional, see text)
1 40-pin single row header socket (CON 2) (Altronics Cat P-5390)
1 40-pin single row header (for LCD module) (Altronics Cat P-5430)
1 90° PC-mount 6-pin header (CON3) (Altronics Cat P-5516)
1 6-pin header socket to suit above (Altronics cat P-5476)
1 SPST tactile membrane switch (S1) (Altronics Cat S-1120)
1 20-pin IC socket (machined pin type)
1 4MHz crystal (HC49 package, parallel resonant) (X1)
1 4-pin disk drive power connector (socket, with male pins) (DSE Cat. P-5120)
1 9-pin female 'D' connector with backshell
1 Universal IR Remote Control (eg, Jaycar Cat. AR-1710)

Semiconductors
1 AT90S2313-4P microcontroller (IC1), programmed with IRRLCD.HEX & IRRLCD.EEP
1 MC34064P-5 under-voltage sensor (IC2) (Altronics Cat. Z-7252)
1 IR receiver (IC3) (Jaycar Cat. ZD-1952; DSE Cat. Z-1955)
1 MAX232 RS232 receiver/driver (IC4)
1 LM7805 5V regulator (REG1)
1 3mm high efficiency red LED (LED1)
1 1N4001 1A diode (D1)

Capacitors
1 100µF 25V PC electrolytic
5 10µF 16V PC electrolytic
3 0.1µF 50V monolithic ceramic
2 27pF 50V ceramic disc

Resistors (0.25W, 1%)
1 10kΩ
1 4.7kΩ
1 180Ω
1 22Ω
1 10kΩ miniature horizontal trimpot (VR1)

Miscellaneous
4 12mm untapped spacers (5mm max. O.D.)
4 M3 x 20mm tapped spacers
4 M2.5 x 20mm screws
4 M2.5 nuts
5 M3 x 6mm c/sunk head screws
4 M3 x 10mm cheese head screws
4 M3 nuts
13 M3 washers
1 TO-220 silicone or mica insulating washer
180mm (approx.) tinned copper wire for links
4-core data cable for serial port connection
Light-duty hookup wire

of a fair slice of this to store parameters such as the baud rate, power-on message and custom LCD characters.

If you're not daunted by the innards of an assembler file, then have a look at the IRREE.ASM file included in the software download – you can open it with any text editor. This file defines the layout of the data stored in the microcontroller's EEPROM.

You can make changes to this file, reassemble it (using any Atmel AVR assembler) and download the resultant IRREE.EEP hex file using the above setup mode feature.

To do this, enter setup mode, and get the "Waiting for data" message on the display as described above. With the board connected to your PC, open HyperTerminal (configured as described earlier) and send the new IRREE.EEP file out the designated serial port using *text only* file transfer. If the transfer is successful, then the LCD should display "Download OK!", otherwise an error message will appear.

If nothing happens, then the data was either not received or was garbled.

Defining custom characters

In addition to the standard character set (see Table 1), the LCD module has eight custom-character slots. These can be really handy, as we found when we needed the classic "play", "stop" and "pause" symbols for our MP3 Jukebox.

LCD characters are composed on a 5 x 8 pixel bitmap. Each character row is defined in one byte, with the upper, unused bits set to zero. Fig.9 gives an example of the values needed to define a single character.

Once you know the bit patterns for your new character, send them to the LCD with the following escape sequence:

ESC D n B0 B1 B2 B3 B4 B5 B6 B7

where 'ESC' identifies the start of a multi-byte instruction, 'D' indicates that this is a custom character definition, 'n' is the character number (from 0-7), and B0-B7 are the byte patterns that define the custom character.

Using the values from our example, the actual string to transmit (in decimal notation) would be:

27 68 00 00 04 08 31 08 04 00 00

The microcontroller maps custom characters to ASCII 128-136, so to display a custom character, use its number (0-7) plus an offset of 128. Listing.2 shows how it all works in a real program. This example, written in QBasic, defines the first three custom character slots and then displays the results.

Programming the micro

If you purchased this project as a kit, then the microcontroller (IC1) will have been pre-programmed and you can ignore the following information. If not, then we have made provisions for programming the chip in-circuit. In common with many recent microcontrollers, the AT90S2313's flash program memory and EEPROM data memory can be electrically erased and programmed while in-circuit. Atmel has assigned alternate functions to three port pins for the task, which we've routed to CON1, the in-circuit serial programming (ISP) header.

To use this feature, you need a free software package from Atmel called AVR ISP. You also need a simple adapter board that connects between your PC's parallel port and CON1 on our board. We hope to describe this board next month.

Finally, the microcontroller program files (including all the source code) are available for free download from the SILICON CHIP website at **www.siliconchip.com.au** SC

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PC CONTROLLED

Everyone, it seems, has an old computer, unused and unloved, gathering dust somewhere. Wouldn't you like to do something useful with it, like controlling external devices? This project has both the hardware and software to do exactly that – and it will work on anything from a 386 up!

Concept, hardware and software design by Trent Jackson
Words by Ross Tester

Initially, this project was designed to turn a swimming pool filter pump on and off at appropriate times. Sure, you can buy a pretty cheap mechanical or electronic timer to do that but with an old 486 lying idle and the possibility – no, make that probability – of controlling a lot more than a pool pump, I thought, why not?

As it turned out, the hardware to do the job is relatively simple and cheap – there are only about twenty components required to give a pretty nifty circuit. The software, though, is a little more complicated – but as I have already done that part for you, all you need to do is build the control box, dust off that old computer, fire it up and load the software.

It uses the parallel (printer) port of just about any PC from, say, 386 vintage onwards. It operates under good, old fashioned DOS (remember that?) – in fact, I wouldn't recommend it being run under Windoze.

The hardware

There is nothing too difficult to either comprehend or build as far as hardware goes. Just remember, though, that this is a mains-powered and mains-controlling device and the circuit "floats" at full mains potential at all times.

There are certain practices and procedures which must be followed for your own safety and that of anyone else using the device (not to mention the longevity of your computer!). Most of all, be extremely cautious when testing or servicing the circuit with the cover off. To be absolutely safe, I'd suggest you do all your testing with a 12V battery powering it. At SILICON CHIP we like our readers and want to keep all of them alive!

We'll show you how to hook in a 12V supply later on.

Speaking of safety, the circuit features fuse and surge protection and has full electrical isolation (by means of an optocoupler) between the mains and the connection to your computer.

Now, let's look at the block diagram, Fig.1, in conjunction with the circuit diagram, Fig. 2.

The first thing you will note is that there is no transformer. The 240V mains is applied via a 10A fuse (for protection against catastrophic failure) and a 275V varistor (to suppress any mains-borne spikes). A capacitor across the mains also assists in filtering out any noise.

Next there is an AC current limiter consisting of a pair of parallel capacitors which together add up to about 1µF. From first principles, we know that series capacitors in an AC circuit offer resistance (or more correctly impedance) to current flow.

This is expressed by the formula

FEATURES

- Low cost, easy to build
- Fuse and surge protection
- Full optical isolation
- System enable function
- Efficient relay switching
- Precision timing
- Control up to four events
- Save and open timer settings

THIS IS A MAINS-POWERED DEVICE AND THE CIRCUITRY IS LIVE (240V AC) WHILE EVER POWER IS CONNECTED, EVEN IF THERE IS NO OUTPUT VOLTAGE. DO NOT ATTEMPT TO BUILD THIS PROJECT IF YOU ARE NOT ENTIRELY FAMILIAR WITH MAINS WIRING PRACTICES AND CONSTRUCTION TECHNIQUES.

MAINS SWITCH

$X_C = 1/2\pi f C$, where X_C is in Ohms, f is the frequency in Hz and C is the capacitance in farads. Therefore, at 50Hz, the two capacitors are going to present an impedance of about 3.2kΩ.

From Ohm's law (I=E/R), we can then deduce that the current will be limited to 240V/3200Ω or about 75mA.

The 47Ω resistor following the series capacitors can be all but ignored for the purpose of this equation – its job is to limit the inrush current which would otherwise occur at switch-on.

The four diodes (D1-D4) form a bridge rectifier across the 240V AC mains, resulting in a pulsating DC voltage output of about 340V (240 x 1.414). Zener diode ZD1 is connected as a shunt regulator across this supply, clamping it to around 12V DC. The two capacitors (C3 and C4) provide further smoothing, resulting in a relatively well-regulated 12V DC supply for the rest of the circuit. A red LED across the 12V supply shows that power is applied.

So far, all we've looked at is the power supply – but there is not much else to it! Turning back to the other input, that from the computer, we see that two pins, Data 1 and Strobe, of the parallel port, provide the signal drive for the switch. Under software control, when Data 1 goes high and the Strobe goes low, D5 and D6 are both forward biased, lighting the LED inside the optocoupler (the 180Ω series resistor limits current from the parallel port to safe levels).

As you can see from this, there is no electrical connection whatsoever between the computer and this circuit. The optocoupler specified, SFH601-3, has been chosen because of its high isolation. Lower rated

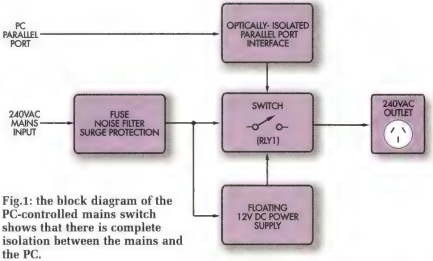


Fig.1: the block diagram of the PC-controlled mains switch shows that there is complete isolation between the mains and the PC.

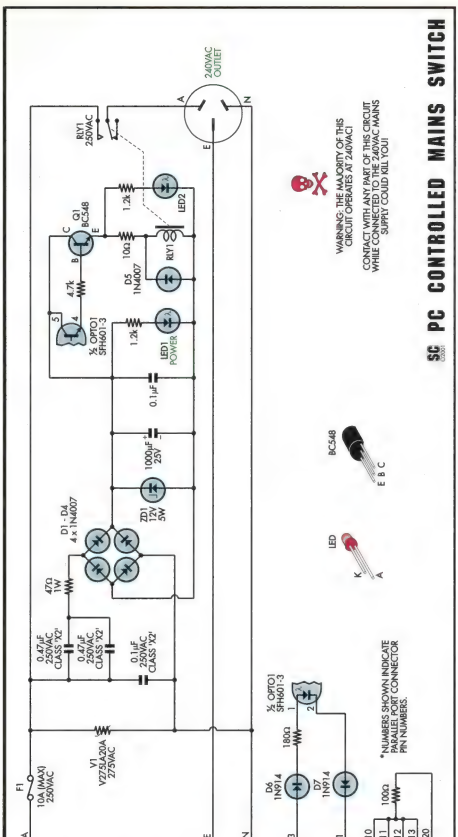


Fig. 2: the complete circuit diagram of the PC-Controlled Mains Switch.

optocouplers should not be used.

When the LED in the optocoupler lights, the transistor in the opto-coupler conducts. This transistor is connected in "Darlington" fashion to Q1 which is then turned on. Current flows from Q1's collector to emitter, through a 10Ω resistor and then through the relay coil, pulling it in and closing the 240V active circuit. Therefore, whatever is connected turns on.

At the same time, the green LED between Q1's emitter and ground also turns on to give indication that 240V power is available.

The reverse-biased diode across the relay coil doesn't normally conduct. Its purpose is to protect Q1 when the optocoupler turns off and the relay de-energises. This can generate a quite high voltage pulse which might destroy Q1; when the relay de-energises the diode becomes forward biased, safely bleeding the pulse away.

Finally, you will note that all 4-bit inputs to the PC parallel port are connected together and tied low, to pin 20. This is essential for the port to operate as we intended. Incidentally, the port must be operated in the "ECP" mode, which can normally be set up via the computer's CMOS setup. ECP, by the way, stands for Enhanced Capabilities Port.

If you don't know how to do this, refer to your computer's manual (or perhaps you shouldn't be attempting this project!).

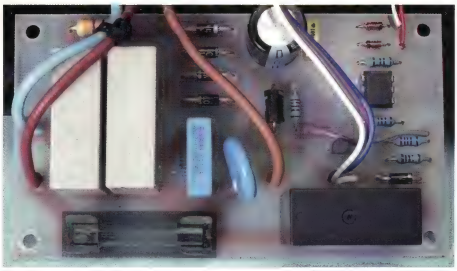
The software

The software, PCMS.EXE, does the vast majority of the "work" – my philosophy is minimum hardware and maximum software! It is written in Q-BASIC and a zipped version can be downloaded from the SILICON CHIP website.

As mentioned before, this should be run in DOS mode. While I have run it under Windows, it occasionally gets upset and freezes. You shouldn't have this problem under DOS.

The software will run without the controller hardware plugged in, so you can get a feel for its operation and features. There is a scrolling message at the bottom of the screen which tells you which keys to press for which operations.

It's also designed to be very user-friendly – once you've used it a couple of times you will get the hang of



The completed PC board with its connections to power, to the mains outlet (GPO), the front panel LEDs and to the computer parallel port. There were some minor differences between this photo and the final version shown below.

it. The heart of the program is the timer settings box. When you first run the program it will load up null settings (0's) for each of the four programmable events.

Timer Settings box

There are two modes. MX is the normal mode and can handle both dates and times.

DX is the alternate mode, used when you want an event to occur on a daily basis (so no date input is needed) Dates are entered in the format MM-DD-YY (eg, 19th September 2001 would be 00-19-01); times are in 24 hour format (8.15pm would be 20:15).

To modify any setting, use the arrow keys (keypad) to move the flashing cursor to the unit you want changed and enter the new setting of the null setting. The backspace key does not delete – move the cursor back and type over. (The backspace key will delete characters in the files box).

Files box

You can save current timer settings in a file and recall it later – press the F4 key to save your current settings and F5 to open any presaved settings.

System box

The current time and date, read from your PC's real time clock, are displayed in the top two boxes. You cannot change these – you must go into your PC's time and date setting procedure (via CMOS setup) to do this.

The Port Address can be changed to match the port address of your computer's parallel port. The default is H378; some computers have theirs at H278 but pressing the F1 key will toggle through the various addresses possible. If you have a valid port address, the port data (immediately underneath) should read between H120 and H148.

Note that the port mode must first

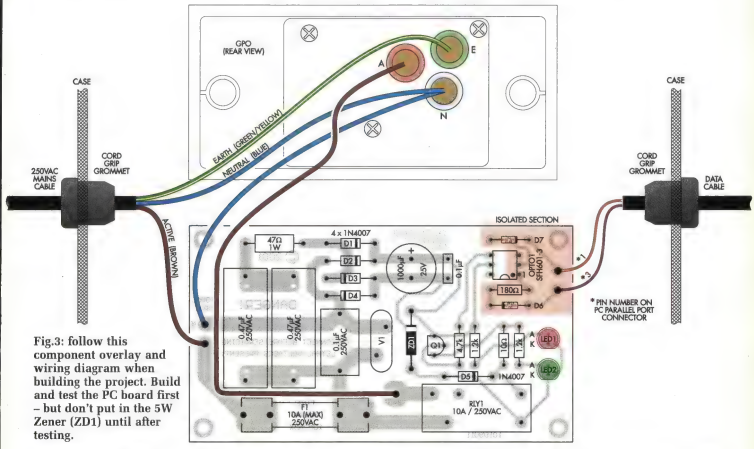
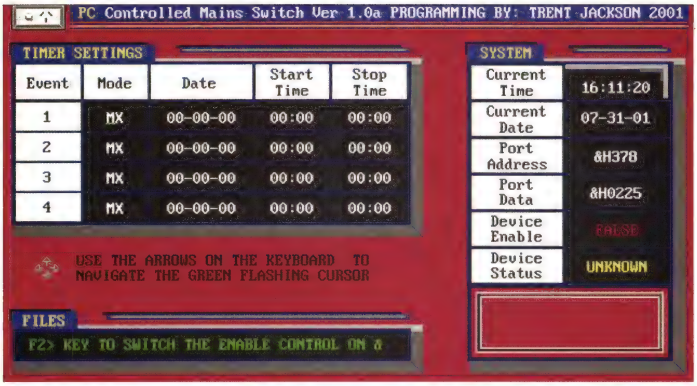


Fig.3: follow this component overlay and wiring diagram when building the project. Build and test the PC board first – but don't put in the 5W Zener (ZD1) until after testing.



Here's what the software, PCMS.EXE, looks like on the screen. You can set the on and off times for up to four events as well as change various parameters as described in the text. Download the software from *www.siliconchip.com.au*

be set to ECP (enhanced capabilities port) mode via your CMOS setup.

The "Device Enable" box is not controlled by the timers; you have to set this manually with the F2 key in order to enable the hardware.

Finally, the "Device Status" box should automatically come up with a "connected" message if your port is functioning correctly and the hardware is connected. If the software has detected errors (eg, no hardware connected or a port malfunction of some sort) it will read unknown.

The big box underneath the System box is a visual indication that everything is working as it should: when the timer turns the hardware on, the box changes from red to green and the message changes from "AC POWER IS OFF" to, surprise surprise, "AC POWER IS ON".

If you don't like the background colour, toggle the F6 key. There are 16 different colours and styles to choose from – there must be something there you'll like!

Construction

Before we start, another word of warning. Please ensure that you follow the construction method **to the letter** – we have gone to a great deal of trouble to ensure that the design is safe and construction methods echo that safety.

For example, do not substitute standard metal bolts and nuts where we specify nylon types – if a nut works its way loose inside the case and shorts out something, you or your PC could disappear in a puff of blue smoke.

As usual, start by visually checking the PC board to ensure there are no etching or drilling defects.

Then commence assembly with the lowest profile components – resistors, varistor and diodes (ensure the diodes are the right way around!). At this stage, don't fit the Zener diode because it will get upset with our checking procedure later.

Next are the smaller capacitors (watch the polarity on the electrolytics), the IC and transistor (ditto) and the fuse clips. Some fuse clips have little lugs on them which will stop a fuse being inserted if they are back-to-front: check yours by in-

The PC board is secured to the case lid with four nylon screws, as shown here. Each screw has a nylon nut on the inside acting as a spacer before the PC board is seated and secured with another nylon nut.

serting a fuse before soldering.

All that's left now are the larger capacitors and the relay. Now we are ready to move on to the wiring which is where you have to be particularly careful to make sure nothing is wrong. The basic premise is that the wires need to be only as long as necessary to reach and not long enough to short to something else if for some reason they come adrift.

Before you do that, though, you should prepare the jiffy box for the external components and wiring.

A 6mm hole is required at each end (for the mains cable and the computer cable), each with a rubber grommet. The bottom of the box is used as the top (the lid becomes the base) and in this you will need two 5mm holes for the LEDs, two 3mm holes for the power outlet mounting screws and finally a 30mm hole for the back of the power outlet to poke through.

All labels should now be glued to the box and left to dry. While that's happening, go over your PC board assembly once more to make sure everything's where it should be. It will be much more difficult to check it later.

Prepare the red and green LEDs by soldering a 100mm length of 4-way rainbow cable to their respective legs. Note which legs are the anode and the cathode (the anode lead is the longer) and then cut both legs very short – say 3mm – and solder the rainbow cable to them leaving as much as the cable intact as you can. Then wrap the soldered joints in insulation tape so that no exposed legs or wire are visible. If necessary, put a piece of tape between the legs to ensure they don't short.

If you've now forgotten which leg was which, the cathodes are the ones adjacent to the flat on the LEDs! Write down the colours of 4-way rainbow cable which go to each leg, and which colours go to which colour LED.

Fit LED mounting collars over them and push them through the bottom of the box. Lock them in place with a dab of silicone sealant, super glue, 5-minute Araldite or other suitable adhesive.

Refer to the wiring diagram for the mains wiring and follow it exactly. Again, only make the leads as long as you need to.

Remove the outer insulation from the three-wire mains lead to a length of 175mm. Cut off 100mm and put it aside – you'll need this as mains hookup wire. Push the wires of the mains lead through the appropriate hole from the outside. You'll need to push through much further than the end of the insulation – at least another 50mm or so, to give you enough room to attach the power outlet.

Take the Neutral (blue) and Earth (green yellow) wires through the large hole in the box to the outside. Remove 15mm of insulation from both. The only connection to the Earth terminal of the power outlet (labeled "E" or perhaps with green or green/yellow marking) is the Earth wire. Bend the bare wire back on itself, push it into the terminal and tighten the grub screw. Ensure there is no exposed wire (especially tiny strands of wire).

Now take that blue length of mains wire you cut off before and strip 15mm

Parts List – PC Controlled Mains Switch

1 PC board, 101 x 57mm, coded 10109011
1 plastic case (Jaycar HB6013 or equivalent)
1 mini switched power outlet (GPO) (HPM 787 or equivalent)
2 cord-grip grommets to suit cables used
2 3AG fuse clips, PC mounting with protective cover
1 10A 3AG fuse
1 SPST relay, 12V coil (220Ω) with 10A 240V-rated contacts (Jaycar SY-4050 or equivalent)
1 piece insulating material to suit – Elephantide or plastic (see text)
5 mini cable ties
6 M3 x 10mm nylon screws
10 M3 nylon nuts
6 spring washers
100mm length 4-way rainbow cable (colours unimportant)
2m length 240V 10A mains lead with moulded 3-pin-plug
2m parallel printer cable (D-25 plug) (without Centronics plug) ***OR***
2m length 2-core shielded cable and 1 D-25 male plug

Semiconductors
1 SFH601-3 optocoupler (OPTO1) (DSE Z9023 – do not substitute)
1 BC548 NPN transistor (Q1)
1 12V 5W Zener diode (ZD1)
1 275VAC Varistor (V1)
5 1N4007 power diodes (D1-D5)
2 1N914 signal diodes (D6, D7)
1 5mm red LED (LED1)
1 5mm green LED (LED2)

Capacitors
1 1000μF 25VW PC mounting electrolytic
2 0.47μF 250V AC X2-class polyester (Code 474 or 470n)
1 0.1μF 250V AC X2-class polyester (Code 104 or 100n)
1 0.1μF MKT polyester (Code 104 or 100n)

Resistors (0.25W, 1%)
1 4.7kΩ 2 1.2kΩ 1 180Ω 1 100Ω 1 10Ω 1 47Ω 1W

Resistor Colour Codes

No.	Value	4-Band Code (1%)	5-Band Code (1%)
1	4.7kΩ	yellow purple red brown	yellow purple black brown brown
2	1.2kΩ	brown red red brown	brown red black brown brown
1	180Ω	brown grey brown brown	brown grey black black brown
1	100Ω	brown black brown brown	brown black black black brown
1	47Ω	yellow purple black brown	yellow purple black gold brown
1	10Ω	brown black black brown	brown black black gold brown

of insulation from it. Tightly twist this and the blue wire coming out of the box together and insert them into the Neutral terminal of the power outlet (labeled "N" or perhaps with blue or black marking) and tighten the grub screw. Ensure there is no exposed wire nor strands of wire.

Now take that brown length of mains wire you cut off before and strip 15mm of insulation from it. Twist the strands together, fold them back on themselves and insert the wire into the Active terminal of the power outlet (labeled "A", perhaps with red or brown marking).

Tighten the grub screw and ensure there is no exposed wire nor strands of wire.

Push the power outlet down onto the box and secure it in place with two 3mm x 10mm nylon bolts and nuts (don't use metal ones!) and spring washers (which should be metal).

Tighten completely and check that the power outlet will not move around at all.

We're not going to connect the mains wiring to the board yet – that will come later after completion and testing. First we will solder the LED wiring (ie, the 4-wire rainbow cable) to the board in the positions shown.

Computer cable

Now it's time for the computer cable. In all probability, you'll be using a "ratted" Centronics printer cable but if you have to make up a new one, that's not too difficult using a standard D-25 male plug and backshell assembly and some 2-core shielded cable. See Fig.4 for the plug detail.

This cable must be passed through the box in similar manner to the mains cable but to hold things together, a short length of heatshrink is first heated onto it. The essential thing about this cable is that none of the wires is long enough to reach the power outlet should one come adrift later. The distance from the side wall of the box to the closest point on the power outlet was 50mm so we cut our cable to 45mm.

That makes it a tight job to solder to the PC board, but it can be done.

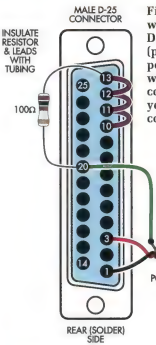


Fig.4: wiring the D-25 (parallel port) plug which connects to your computer.

Front and rear close-up views of case. You will note that for safety there are no metal screws used – the warning on the back panel means what it says! You should not build this project if you are not experienced in mains wiring construction.

Testing

As we said before, for safety's sake you really should check the operation with a 12V battery. The easiest way to do this is with a pair of wires temporarily soldered to the back of the PC board across where the Zener would normally go – just watch the polarity.

Apply 12V power and ensure that the red LED lights. The green LED should not light nor should you hear the relay click in.

If OK, plug the D-25 connector into your computer's parallel port and run the pcms.exe software (in DOS mode). Remember to set the port to ECP mode at boot-up.

Following the processes outlined above, ensure that the software does indeed control the board as intended. You can check the relay operation with a multimeter.

If all is OK, turn off power, disconnect from the computer and remove

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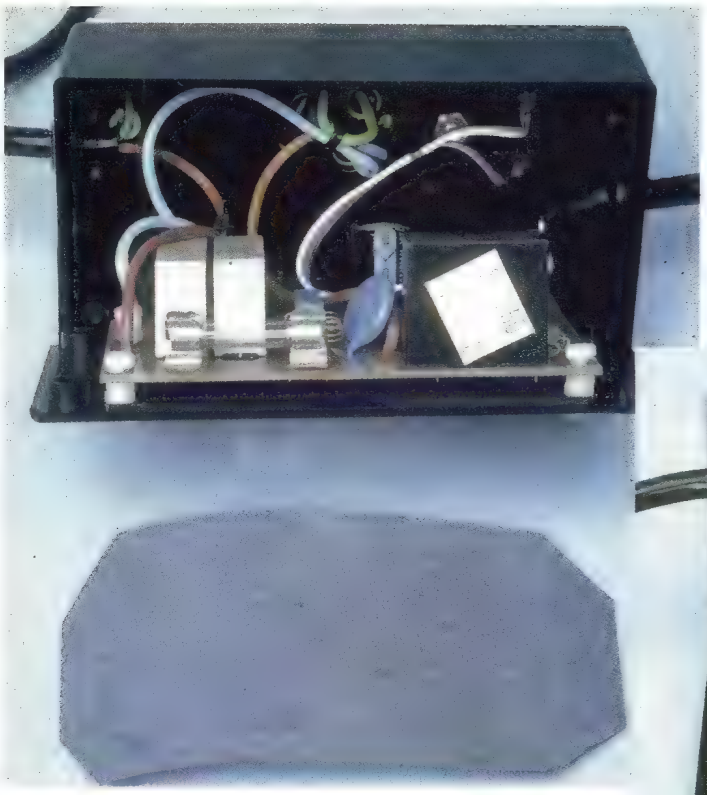
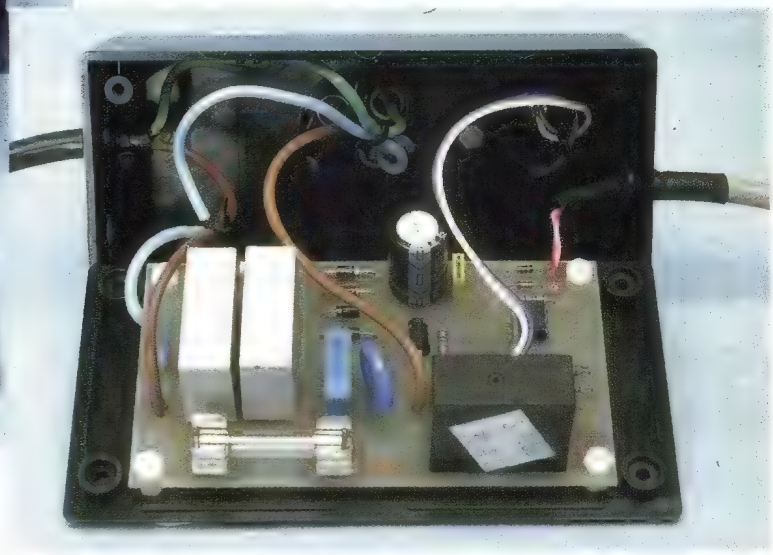
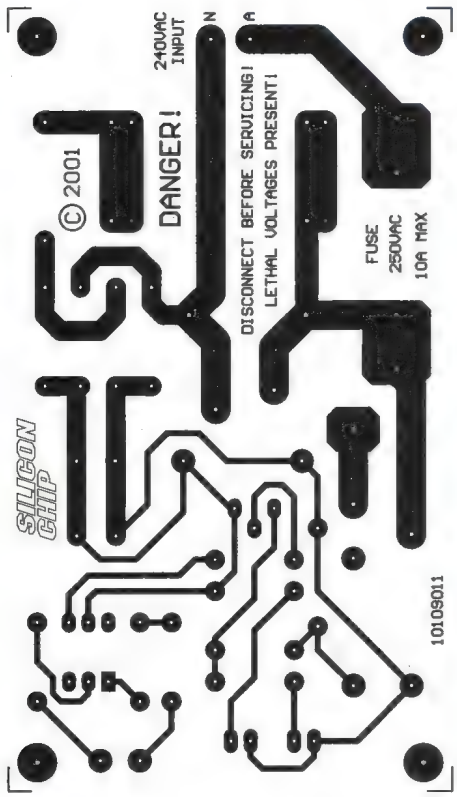


Almost ready to close – these two photos more clearly show the wiring between the PC board and the power outlet on the front panel, and also the wiring to the LEDs and to the computer parallel port plug. At left is the sheet of insulation material, a piece of elephantide or similar, or it can be cut from a plastic sheet such as an ice-cream container. which is inserted between the PC board (component side) and the wiring to the power outlet. It's just another bit of insurance should the "impossible to happen" happen – a wire works its way loose which could jeopardise the inherent safety built into the switch.





Same-size PC board pattern and labels for the back and front of the case. The labels should be glued on before final assembly. On the front panel, the largest hole is 40mm diameter, the LED holes are 5mm and the other two are 4mm. Use a copy of the label as a template for drilling the case. The PC board pattern and labels can be downloaded from www.siliconchip.com.au

Another view of the almost-completed project, this time from above and with the insulation in place. Once again, note the use of nylon nuts and bolts – for safety reasons.

the two wires you temporarily soldered to the back of the board and solder in the Zener diode (the right way around). Make sure you don't leave any solder bridges or splashes.

Mains wiring

Follow the wiring diagram exactly. The brown wire from the power outlet solders to the centre of the PC board, the blue wire from the power outlet solders to the edge of the board and the brown wire from the mains lead also solders to the edge of the PC board. To complete, fit some form of insulating cover over the fuse.

Final assembly

It is important to fit cable ties to hold the various lengths of wiring together – this should ensure that wiring cannot move around in the event of something coming adrift. Cable ties must also be fitted to the mains cable and the parallel cable on the inside of the grommets to prevent the cables from being either pulled out or flexed unduly.

Now the PC board must be secured to the case "lid" with nylon nuts and bolts. This again is not real easy given the fact that the wiring lengths have been kept short. But it can be done! First drill the case lid in the positions shown and fit a nylon bolt and nut to each of the holes. Tighten completely, then slide the PC board down onto the nuts and fit another nut to the top side. Ensure these are also tightened.

Before screwing this assembly into the box, cut a piece of insulation material the size of the box with corners trimmed for the mounting pillars. This goes between the mains outlet and the PC board components. Elephantide has been traditionally used for this role; a piece of thin plastic (eg, cut from an ice-cream container) would serve as well.

Slide this insulation into the box, push the PC board and lid assembly down on top of it and fit the four case screws. Your PC controlled switch is now finished and should work exactly the same way as when you tested it. **SC**

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PRODUCT SHOWCASE

Ethernet modules from Rabbit Semiconductor

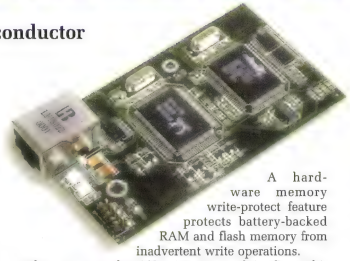
Rabbit Semiconductor has added two new Ethernet core modules to the popular RabbitCore product line. No bigger than a credit card, these modules include the high-performance Rabbit microprocessor, up to one megabyte of memory (flash and SRAM), an Ethernet interface and connector. In addition, the four serial ports, battery-backable clock, cold boot capability, a slave mode and up to 40 I/O lines make product design fast and economical.

The Rabbit 2000 is an 8-bit microprocessor with a C-friendly instruction set, fast number crunching ability and features such a four serial ports, a slave port, remote bootstrap capability, advanced clocking options and glueless interfacing to both memory and I/O. With a clock speed up to 30MHz, the Rabbit 2000 outperforms alternative processors, making it a substitute for 16 and 32-bit processors at a much lower system cost.

The Rabbit 2000 features an updated Z180 style architecture to allow 1-byte operation codes for new instructions. Existing Z180 assembly language can also be ported to the Rabbit 2000 with minimal change.

New C-friendly instructions are included for fetching and storing 16-bit words located at a computed memory address or on the stack. New instructions perform fetches, stores, calls, returns and jumps over a full megabyte of address space. Memory access instructions can be turned into I/O access instructions by using a prefix. As a consequence, I/O access is faster and more flexible.

The Rabbit 2000 has a special support feature for battery-backed RAM. In typical processors, a battery switch-over circuit maintains at least 2V of supply to RAM and pulls the chip select line up to the same voltage as the battery. This method has a propagation delay as much as 20 nanoseconds. The Rabbit's special battery backup feature allows chip select #1 to be always forced low under program control, thus avoiding clock slow down.



A hardware memory write-protect feature protects battery-backed RAM and flash memory from inadvertent write operations.

There are 40-plus I/O pins grouped in five 8-bit ports. Eight external programmable I/O interface signals can be configured as I/O chip selects, I/O write strobes, I/O read strobes and I/O read/write strobes. Standard I/O read and I/O write enable signals are also available. I/O devices can be directly connected to the I/O interfaces, and often without glue logic. Four asynchronous serial ports are on-chip. Two of the ports also have synchronous communication capability. The asynchronous ports operate at speeds up to 1/32 of the clock frequency, while synchronous mode allows baud rates up to 1/8th of the clock frequency.

For further information on the Rabbit 2000 and the Ethernet core modules, contact the Australian distributor, Dominion Electronics or visit their website.

Contact:
Dominion Electronics
Suite 201, 82 Christie St, St Leonards NSW 2065
Phone: (02) 9906 6988 Fax (02) 9906 7145
Website: www.dominion.net.au

Jaycar opens its first Macarthur region store

Jaycar Electronics newest store in Campbelltown, NSW will employ up to five local staff in a combination of full time and casual positions.

Jaycar brings to Campbelltown many years of retail experience and a proven product range covering alarm systems, test equipment, video surveillance, car audio, electrical & electronic tools, wire, cable and accessories. Jaycar is also known for its extensive range of electronic hobbyist kits.

Gary Johnston, Managing Director of Jaycar said, "We recognise Campbelltown as a regional growth center and want to be part of that growth". "With its major administrative and educational infrastructure, Campbelltown is a natural choice for our newest store and we are pleased to be here and part of the ongoing development of the Macarthur region"

Jaycar's new store is located in Shop 2, 49 Queen St (Cnr Langdon Ave.) in Campbelltown. Phone 4620-7155

Contact:
Jaycar Electronics
100 Silverwater Rd, Silverwater NSW 2128
Phone: (02) 9741 8567
Fax (02) 9741 8588
Website: www.jaycar.com.au

See-in-the-dark video "Snooper" from DSE

Elsewhere in this issue we feature the SOOPER SNOOPER. Well, here's the video equivalent – the Apple Nightowl from Dick Smith Electronics.

The Nightowl allows you to view up to 100 metres in absolute darkness, 150 metres in starlight or 200 metres in moonlight. You view the scene through the Nightowl's video imager, which shows in a monotone green.

Suggested uses (apart from snooping!) include security guards, nature lovers studying nocturnal wildlife (they don't say what or how wild!) and even for boat owners trying to pick up that elusive mooring in the dark.

The Nightowl has 7000x light amplification and 3.6x image magnification. It is powered by two AA batteries and weighs in at 585 grams. A soft carry case is included.

The Applie Nightowl is available from all Dick Smith PowerHouse stores in NSW and Victoria for $598.00. It is also available via mail orders (1300 366 644) or through www.dse.com.au.

Contact:
Dick Smith Electronics
2 Davidson St, Chullora NSW 2190
Phone: (02) 9642 9100
Fax (02) 9642 9153
Website: www.dse.com.au

Honey, I shrunk the keyboard . . .

If you're a bit tight on space (or don't like a big keyboard taking up real estate!) Microgram have this nifty little PS-2 keyboard available.

The keys and key spacing are full size, so you won't have any excuse for poor typing, but everything else about this keyboard is tiny. It measures just 295 x 145mm and is about 35mm deep at the back. Naturally, they've had to sacrifice the numeric keypad (it piggy-backs on some of the alpha keys) but all other keys are there, if a little smaller than usual!

You can check this little number out by calling Microgram or visiting their website.

Contact:
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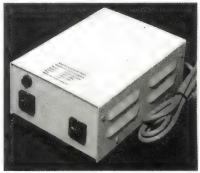

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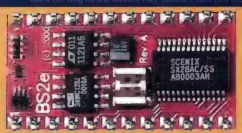

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BASIC Stamp development kit from RTN

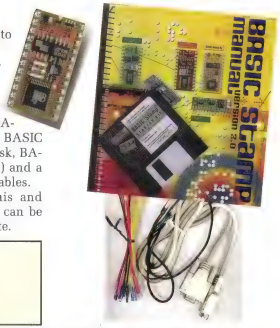
To say that the BASIC Stamp has enjoyed phenomenal success is akin to saying that computers are popular!

As a means of "getting into" microcontrollers, there is probably none better. With their easy-to-learn (and even easier to understand) language there are literally hundreds of thousands of people who started out with the BASIC Stamp.

This popularity has spawned a huge library of Stamp applications, with dozens of websites, user groups and newsgroups devoted to the subject. A great place to start is the manufacturer's website, www.parallaxinc.com. Or try typing "Basic Stamp" into any search engine (Google is accessible from the SILICON CHIP website) and you'll see what we mean (about 290,000 references, according to Google!)

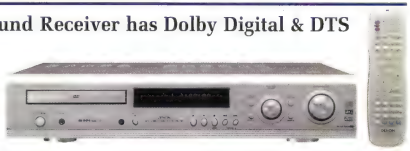
The BASIC Stamp development kit, available from RTN allows users to develop and debug their own BASIC Stamp designs. It features a BASIC Stamp BS2p 24 module, BASIC Stamp starter kit on floppy disk, BASIC Stamp manual (Version 2) and a selection of interconnecting cables.

Further information on this and other BASIC Stamp products can be obtained from the RTN website.



Contact:
RTN
35 Woolart St Strathmore Vic 3041
Phone/Fax (03) 9338 3306
Website: www.nollet.com.au

Denon's 5-channel DVD Surround Receiver has Dolby Digital & DTS



Denon's newest model, the ADV-700 surround receiver, is equipped with both Dolby Digital and DTS 5.1 channel decoding, along with a Dolbt Pro Logic II decoder which simulates 5.1 surround sound from a 2-channel (stereo) source, such as conventional CDs, discs and tapes.

DVD discs can be in either NTSC or PAL format. You have the option of composite video or S-video output while DVDs also have RGB output as well.

In audio mode, when you insert a disc, the ADV-700 automatically detects the sound format and plays it in the appropriate mode. It also does this with digital broadcast satellite (DBS) signals.

In addition, the receiver also automatically detects CD-R and CD-RW discs recorded in MP3 format.

Three sets of video terminals and four sets of audio terminals are provided to connect a video player, TV or other video and audio devices. The ADV-700 allows you to make system settings via your TV screen.

It also includes FM and AM tuners covering 87.5-108MHz and 522-1611kHz.

Each of the power amplifiers is rated at 35W RMS (6 ohms, 1kHz, 10% THD).

While many of the functions are controlled via the front panel, there is an extremely comprehensive infrared remote control unit for all functions.

Denon models are handled by selected hifi and video retailers. For the location of your nearest retailer, contact the Australian distributors of Denon, Audio Producs Australia.

Contact:
Audio Products Australia Pty Ltd
67 O'Riordan St, Alexandria NSW 2015
Phone (02) 9669 3477 Fax (02) 9578 0140
Website: http://elec.denon.co.jp/europe/

First MiniDisc player to feature Dolby Headphone

Sharp Corporation has launched the new MD-ST880 MD player featuring the Dolby Headphone technology developed by Australian company Lake Technology.

Dolby Headphone delivers a spatialised stereo sound experience over any ordinary stereo headphones.

The ST880 features MiniDisc Long Play, a new encoding method for audio on MiniDisc which effectively doubles the storage capacity. MPLP offers two long play modes: LP2 which will record 160 minutes in stereo and LP4 which uses greater compression to allow 320 minutes recording time in stereo.

Sharp announced earlier this week the new DV-L90TC DVD Mobile Theatre with Dolby Headphone, while in the PC sector, Sharp feature Dolby Headphone in their recently announced PC-MJ760C, an A4-size all-in-one notebook PC, part of a four model range.

Lake Technology also announced this week a commercial partnership with one of the leading music software companies, MUSICMATCH Inc, which will see an aggressive roll-out of the Lake-branded Dolby Headphone plug-in for MUSICMATCH Jukebox.

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Lake Technology Ltd
Box 736 Broadway NSW 2007
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NEW

This new learning key FOB remote is similar to our existing remote (LA8990), but with a wider frequency range that includes many automatic garage door openers. Will learn up to 4 different codes and make your life a little easier by letting you control all your alarms with just one FOB. Use the same remote for your car, your partner's car and the automatic garage door with a spare button for the house alarm when you get it. Great value and convenience! Not suitable for code hopping alarms. **Cat. LA-8992** **$49.95**

FANTASTIC BARGAIN PACK

NEW

Contains a minimum of 100 pcs. of LEDs/displays etc. All are high quality Everlight brand and will include the following LEDS; •3mm •5mm •high brightness •10mm •4 way LED module (which are counted as 1 LED) • 7 segment display plus more. A typical pack is pictured, but we cannot, of course, guarantee every pack will be exactly the same as pictured. We do know, however that for $8.95, you get an absolute bargain. **Cat. ZD-1700** **$8.95**

NEW RANGE OF SWITCHMODE PLUGPACKS

These new PowerTechPlus switchmode AC adaptors feature a regulated and stabilised output, short circuit and over-voltage protection, and high efficiency in a much lighter and smaller package.

PowerTechPlus

NEW

5VDC @ 2.5A	Cat. MP-3140	$39.95
6VDC @ 2A	Cat. MP-3141	$37.95
9VDC @ 1A	Cat. MP-3136	$32.95
12VDC @ 1A	Cat. MP-3137	$32.95
3, 4.5, 5, 6, 9,12VDC @ 1A	Cat. MP-3130	$32.95
3, 4.5, 5, 6, 6.5 @ 2.5A		$42.95
7VDC @ 1.7A	Cat. MP-3131	
9,12,15VDC @1.5A; 18, 20VDC@1.2A, 24VDC@1A	Cat. MP-3420	$49.95
15VDC@1.5A	Cat. MP-3423	$42.95
18VDC@1.2A	Cat. MP-3424	$42.95
12VDC@2.5A 13.8VDC@2.2A	Cat. MP-3434 Cat. MP-3435	$59.95ea

TABLETOP UNIVERSAL REMOTE CONTROL

NEW

This tabletop universal remote control is pre-programmed with all widely used codes and is fully programmable as well. Use it to command your TV, VCR, SAT, AMP, CD, LD, DVD, tuner, cable box, etc all at once. Unit includes 2 x AA Ni-MH batteries and features an LCD display with EL backlight with matching illuminated buttons to help navigating in the dark. Measures 167(L) x 180(W) x 50(H)mm. See cat page 183 for details.

Cat. AR-1715 **$399**

REMOTE CONTROL A/V SELECTOR/SCANNER

NEW

This quality 4-way audio-visual source switcher supports both RCA and S-VHS plugs. Suitable for interfacing a camcorder, DVD, VCD, CD player, games console, VCR, etc to your TV. Features include a fully functioning remote control unit and scanning function to automatically switch input signals and adjust interval time for surveillance purposes making it ideal as a CCD switcher. Output is amplified to compensate for signal loss. Size 200W x 55H x 130Dmm and is supplied complete with mains plug pack. **Cat. AC-1670** **$119**

High Quality 5.5" Electrical Shears with Pouch

NEW

These shears offer impressive cutting ability with finely honed and serrated blades. Great for cutting insulation, heatshrink, spaghetti and light hook-up wire. The shears feature insulated handles and are supplied with a heavy duty nylon belt pouch. **Cat. TH-1756** **$27.95**

SENSATIONAL KOSS HEADPHONES DEAL

NEW

When FORD in the US wanted to include two quality sets of headphones in each of one of their up-market vehicles, they chose KOSS to supply them. We don't have specifications but our experts tested them, and we purchased the lot because they sounded so good. The headphones are lightweight have an adjustable headband and soft foam ear pads. They come fitted with a 2.4 metre cable which is terminated with a stereo plug. At the price, just one pair of these KOSS headphones would be good value, but we supply 2 full sets packaged in a complimentary storage case. Sensational value. Limited quantity available. Made in USA.

Two versions are available.

Cat. AA-2046 with 6.5mm plug
Cat. AA-2048 with 3.5mm plug

$39.95 for two pairs

NEW JAYCAR STORES

CAMPBELLTOWN
Shop 2, 49 Queen St (Cnr Langdon Ave)
Campbelltown NSW 2560
Ph: (02) 4620 7155
Fax: (02) 4620 7866

THE GOLD COAST
2474 Gold Coast Hwy
Mermaid Beach
QLD 4218
Ph: (07) 5526 6722
Fax: (07) 5526 6733

MAILORDERS - FREECALL FOR PHONE ORDERS - 1800 022 888

AMAZING TECHNOLOGY BREAKTHROUGH

EXCLUSIVE TO JAYCAR – Day/Night Colour CCD Camera with Sony® Sensor, I/R Capability, Auto-iris Controller & Audio

This camera is unique among colour CCD cameras in that it can operate in 0 Lux lighting conditions when used with our optional infrared illumination lenses. The camera automatically detects I/R illumination & adjusts itself for optimum picture quality. An electret microphone is fitted for sound & a Sony® 1/3" CCD image sensor provides over 420 TV line resolution. The camera will accept our standard CCTV lenses as well as our auto-iris lens. Sensitivity is 1 Lux at f2 with non-I/R lenses. The camera is fitted with both top and bottom mounting threads for fitting on standard mounting brackets or it can be housed in an indoor/outdoor enclosure. Lenses sold separately. Requires a 12 volt regulated supply at 160mA (320 with I/R) •Sensor: 1/3" Sony® sensor •Pixels: 500(h) x 582(v) •Resolution: 420 Lines •Min. Lux: 1 (0 with I/R lens) •S/N: >48dB •Shutter Speed: 1/100000 sec. Auto •Power Required: 12V DC +/-10% •Current Draw: 160mA (320 with I/R) •I/R Range: Up to 10m •Dimensions: 62(W) x 50(H) x 108(D)mm •Video Output: 1Vpp, 75 Ohm. **Cat. QC-3321**

NEW

$379

CCTV Lenses with Infrared Illumination (for QC-3321)

This range of illuminated lenses features 12 forward facing infra-red LEDs to light the area directly in front of the lens and enable the camera to 'see' in total darkness. The lenses are fitted with a standard CS, threaded camera mount and powered from the camera's power supply. An inbuilt sensor turns the LEDs on when the light level drops below 10 Lux to provide unattended operation.

- Power 12VDC @ 160mA
- Illumination range: 10 metres
- Focus range: 40cm to infinity

NEW

$119 EA

Three Versions Available

4mm Lens	6mm Lens	8mm Lens
Cat. QC-3322	Cat. QC-3323	Cat. QC-3324

480 TV LINE HIGH RESOLUTION COLOUR CCD CAMERA

WITH AUTO-IRIS CONTROLLER & GEN-LOCK FUNCTION

NEW

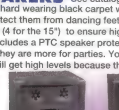
This excellent camera features an external trigger function that enables the camera to be synchronised to others in a multiple camera installation, and thus eliminate the problem of 'image roll' as the system monitor is switched between cameras. A 1/3" Sony® Colour Image Sensor chip is used to provide a 480-line high-resolution image and long service life. It is ideal for use in well-lit areas such as homes, offices or showrooms and will accept both C & CS type lenses. Fitting the appropriate 4mm, 6mm, or 8mm high-resolution lens gives close-up or wide-angle views. Other features include Auto Iris controller and low current consumption. The camera a 12VDC regulated power supply. Use our MP-3011-12VDC 300mA Regulated AC Adaptor. Lens sold separately; QC-3315-4mm, QC-3316-6mm, QC-3317-8mm. •Lead Supplied: 2.1mm DC-12VDC, BNC-video & EXT-VD, 4 pin auto iris •Sensor: 1/3" Sony® Sensor •Pixels: 752(h) x 582(v) •Resolution: 480 Lines Min. Lux: 2 Lux •S/N: >48dB •Shutter Speed: 1/100000 sec. Auto •Power Required: 12V DC +/-10% •Gamma: 0.45 •Current Draw: 200mA •Video Output: 1Vpp, 75 Ohm •Dimensions: 118(W) x 62(H) x 50(D)mm **Cat. QC-3312**

$469

PARTY SPEAKERS

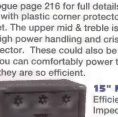
See catalogue page 216 for full details.

These speakers feature hard wearing black carpet with plastic corner protectors and a tough metal grille to protect them from dancing feet. The upper mid & treble is handled by 3 piezo drivers for the 12" (4 for the 15") to ensure high power handling and crisp high frequency protection. Includes a PTC speaker protector. These could also be used for PA applications but really, they are more for parties. You can comfortably power these from as little as 30WRMS and still get high levels because they are so efficient.



12" Model
Efficiency: 93dB/W
Impedance: 8 ohms
Power handling: 100WRMS
Box size: 690 x 385 x 350 mm
Cat. CS-2512
*2 needed for stereo

$159ea*



15" Model
Efficiency: 94dB/W
Impedance: 8 ohms
Power handling: 120WRMS
Box size: 740 x 505 x 350 mm
Cat. CS-2515
*2 needed for stereo

$209ea*

HIGH TORQUE MOTORS

THESE ARE NOT HOBBY MOTORS

NEW

Each of these motors features a hardened steel drive shaft, sintered bearings & quality commutator brushes. These compact, high-torque electric motors are supplied complete with comprehensive data sheets. See cat P272 for details.

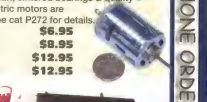
6VDC 9000RPM - 80g/cm	Cat. YM-2712	**$6.95**
12VDC 8100RPM - 80g/cm	Cat. YM-2716	**$8.95**
7.2VDC 8200RPM - 600g/cm	Cat. YM-2714	**$12.95**
12VDC 6500RPM - 1300g/cm	Cat. YM-2718	**$12.95**

SAVE

PARROT CLIPS

NEW

The PARROT Clip is the only test probe, which provides both clip-on hands free contact as with an EZ-hook and normal point contact like a test probe. These feature a sprung hook, which is soldered directly to the lead and housed inside a round metal tube. The grip is performed between the 2 metal parts, which can be used as pincers if required. Probes are supplied with 1m leads terminated to banana plugs and are fully insulated to 1000V. **Cat. WT-5330**



$19.95pr

Super Bright Rechargeable 6V Halogen Torch

This attractive, high powered rechargeable torch uses an energy efficient Halogen globe to produce a very bright beam and will last up to 2 hours. An adjustable stand is integrated into the base of the torch, which allows fully hands free operation. An adjustable shoulder strap is included as is a mains adaptor for charging the internal 6 Volt SLA 4Ah battery. **Cat. ST-3086**

NEW

$47.95

AURA INTERACTOR BACKPACK & CUSHION

CRAZY PRICES

This is by far the best, and now most cost effective way of adding a new dimension to your home computer, video gaming console, or TV.

Backpack

Cat. XC-1000

Some of the cartons are slightly scuffed, but the contents inside are perfect!

$19.95

KITS INCLUDE:

Cable Set	
Cat XC-1001	**$9.95**
15W Amplifier	
Cat. XC-1006	**$5.00**
Shaker Actuator*	
Cat. XC-1008	**$24.95**
Power Supply	
Cat. MP-3055	**$24.95**
Total Value	**$64.85**

*Installed inside both the Backpack & Cushion

Cushion

Cat. XC-1005

$29.95

SPEAKER CABLE MADNESS

Limited quantity available of these cables.

Deal 1 **Be quick and save a fortune.**

We have 50 rolls only of Jumbo Speaker Cable. Figure 8, 259 strands of 0.12mm each side, DC resistance 0.003 ohms per foot. Inductance 0.23uH per foot. Clear colour with trace

Cat WB1733 100m roll

Normally $300/roll NOW $200/roll

Limit one roll per customer

Deal 2

We have 200 rolls of Heavy Duty figure 8 speaker cable, Size 24 strands of 0.2mm each side. Clear colour with trace. Cat WB1707 100m roll

Normally $67.50/roll NOW $40/roll

COMPUTER & NETWORKING ACCESSORIES SALES BARGAINS

OVERNIGHT DELIVERY

LCD PRO LAN TESTER WITH 4 TERMINATORS

This intelligent network cable tester will test your cables for continuity, crossed wires and is supplied with 4 terminators with unique ID's to minimises the number of trips you need to make from the hub to each hub. Designed for professional use. See catalogue.
Cat. XC-5080 Was $239.95
Save $40 NOW $199.95

4 Additional Terminators
Suits LCD Lan Tester
This kit contains 4 additional terminators (ID# 5, 6, 7, 8). See catalogue P155 for details.
Cat. XC-5087
Was $99.95
NOW $69.95

Save $30

IDE HOTSWAP PLUG & PLAY

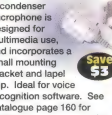
This IDE universal drive bay is compatible with your Hard-Disk, LS-120, MO, Zip, TR-4 tape drives, and ATA flash memory readers. Offers true dynamic Plug & Play capability. See catalogue page 158 for details.
Cat. XC-4673
Was $89.95
Save $10 NOW $78.95

IDE MOBILE HARD DISK CASE

This removable disk drive carrier allows transportation of large chunks of data along with the added security of being able to remove and store your hard drive in a secure safe, protecting your valuable information. See catalogue page 158 for details.
Cat. XC-4670
Was $25
Save $5.05 NOW $19.95

COMPUTER MICROPHONE

This omni-directional condenser microphone is designed for multimedia use, and incorporates a small mounting bracket and lapel clip. Ideal for voice recognition software. See catalogue page 160 for details.
Cat. AM-4081
Was $9.95
Save $3 NOW $6.95



NETWORK CABLE TRACER TONE GENERATOR

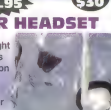
At last a simply and effective tool to help troubleshoot network cables. Features both visual and audible test indicators. See catalogue page 155 for details.
Cat. XC-5083
Was $199
Save $20 NOW $179

COLOURED CD JEWEL CASES

This packet of 5 CD jewel cases contain one blue, green, yellow, orange, and pink transparent case. See catalogue page 160 for details. **Cat. AR-1465**
Was $3.25
Save 70¢ NOW $2.55

COMPUTER HEADSET

Perfect for online chatting, this lightweight microphone headset is designed for connection to your PC,s soundcard. See catalogue page 160 for details.
Cat. AA-2028
Was $14.95
Save $5 Now $9.95



LANTEST REMOTE NET TESTER

Suitable for TIA568A/568B, Token ring, 10/100 Base-T (STP/UTP) networks. Supplied in soft Vinyl pouch. See catalogue page 155 for details.
Cat. XC-5082
Was $209
Save $20 NOW $189

4 PORT USB HUB

This device allows you to connect up to 4 devices from a single connection to you PC or MAC. See cat P161.
Cat. XC-4820
Was $54.95
Save $10 NOW $44.95

ATX MINI TOWER CASE

This mini tower case features a 250W Switchmode power supply, boasts 3 x 5.25" and 2 x 3.5" floppy disk bays as well as 7 rear peripheral slots.
•200Wx430Dx340Hmm
Cat. XC-4635
Was $79.50
Save $10 $69.50

COLOUR CDR MARKER PENS FOUR PACK

$9.95

Specially designed permanent markers for labeling CDR's. Colours include Black, Green, Blue and Red. Cat. TM-3040

GENDER BENDERS

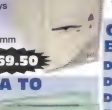
DB15 Male/Male Cat. PA-0870 NEW! $4.95ea
DB15 Female/Female Cat. PA-0871
DBHD15 Male/Male Cat. PA-0875 $5.95ea
DBHD15 Female/Female Cat. PA-0876

COMPACT FLASH & SMARTMEDIA CARD READER

This high speed USB flashcard reader suits both CompactFlash and Smartmedia type cards and features true 'plug and play' capability. See catalogue page 156 for details.
Cat. XC-4770
Was $149.95
Save $20 NOW $129.95

SMARTMEDIA TO PC CARD ADAPTOR

This adaptor allows high speed data transfer from Smartmedia cards to your laptop computer. Standard PC card form factor. See catalogue page 156 for details.
Cat. XC-4780
Was $124.95
Save $20 NOW $104.95



COMPACTFLASH TO PC CARD ADAPTOR

This adaptor allows high-speed data transfer from Compactflash cards to your laptop computer. Standard PC card form factor. See catalogue page 156 for details.
Cat. XC-4779
$24.95

PRICES SLASHED AGAIN ON DATA STORAGE MEDIA!

CDR's and CD-RW's

Ideal for file storage and backups

	CAT	Buy 1	Buy 10	Was
RIDATA 80MIN AUDIO	XC-4705	$1.65	$14.50	$1.95
TDK DIGITAL AUDIO	XC-4706	$1.95	$17.50	$3.50
MITSUI GOLD	XC-4709	$1.65	$14.50	$2.65
PHILIPS GOLD	XC-4711	$1.95	$17.50	$2.45
PRINCO 80MIN	XC-4713	$1.65	$14.50	$1.95
PYROD BLACK 80MIN	XC-4714	$1.65	$14.50	$2.25
AVALON PLATINUM	XC-4715	$1.20	$10.50	$1.50
AVALON CD-RW	XC-4720	$2.50	$22.10	$2.95
B GRADE	XC-4729	$1.00	$ 8.00	
10 Pkt JAYCAR PLATINUM IN SLEEVES	XC-4716	$9.95		
10 Pkt PYROD SILVER IN SLEEVES	XC-4717	$9.95		
25 Pkt PYROD SILVER ON CAROUSEL	XC-4712	$23.95		
50 Pkt PYROD SILVER ON CAROUSEL	XC-4718	$39.95		

MEMORY CARDS

Perfect for digital cameras PDA's, PC's, MP3 players etc!

CompactFlash™

Rewritable, non-volatile storage. Fully compatible with CFA & PC Card ATA standard.
•36.4x42.8x3.3mm

		WAS	Now	SAVE
16mB	XC-4771	$79.95	$74.95	$5
32mB	XC-4772	$119.95	$99.95	$20
64mB	XC-4773	$199.95	$169.95	$30
128mB	XC-4774	$349	$309.00	$40

Smartmedia™

Rewritable, non-volatile storage medium for high capacity portable devices such as Digital Cameras, PDAs, MP3 players etc. Fully compatible with PCMCIA release 2.1.
•45 x 37x 0.76mm
See cat page 156 for our range of memory cards, adaptors and readers

		WAS	Now	SAVE
16mB	XC-4775	$64.95	$54.95	$10
32mB	XC-4776	$119	$89.00	$30
64mB	XC-4777	$209	$169.00	$40

LIGHT DIMMER MODULE

This light dimmer module uses pulse-width moduiation to control the brightness of 240VAC operated incandescent globes. Maximum load capacity is 300VA. See catalogue page 129 for details. Cat. PS-4080

Was $17.95 Save $5 **Now $12.95**

HEADSET WITH HANDS FREE MICROPHONE

This headset is ideally suited to situation were hands free communication is essential. Also suitable for use with 2-way radios in vehicles. Terminated with a 3.5mm stereo phono plug. See catalogue page 226 for details.

Cat. AA-2018

Was $29.95 Save $10 **Now $19.95**

12VDC ACTIVE COLOUR ANTENNA

Ideal for caravans, cars, camping, and domestic use, this active colour antenna operates from 12VDC and is supplied with a 6 metre signal and power lead. See catalogue page 187 for details.

Cat. LT-3170

Was $59.95 Save $10 **Now $49.95**

ULTRASONIC DIMENSION PRO

This product provides an instantaneous and easy means of measuring room dimensions up to 12.5 metres. Measuring point is marked by red laser dot. Ideal for painters and renovators to produce a rough quotation in seconds. See catalogue page 264 for details.

Cat. QM-1620

Was $69.95 Save $20 **Now $49.95**

SEND EMAIL ORDERS TO mailorders@ jaycar.com.au

UNIVERSAL NICAD and Ni-MH BATTERY CHARGER DISCHARGER & TESTER

Save $9

This economical battery charger features a discharge function for proper cycling both Ni-Cad and Ni-MH batteries. See catalogue page 135 for details.

Cat. MB-3505

Was $28.95 **Now $19.95**

Heavy Duty 6A Battery Charger with Trickle Charge

This charger is suitable for both 6 and 12 volt car, boat, motorcycle and lawnmower batteries and features LED charge indicators. The charger can be switched between trickle or heavy duty charge rates. The charger also features overload and reverse battery protection. The battery leads are terminated to heavy duty alligator clips on a 1M length of cable. See cat P140 for details. **Cat. MB-3522**

$69.95

1.5 Amp Regulated 3,4.5,6,7.5,9 or 12VDC Power Supply

This versatile power supply has 6 voltage settings selectable via a rotary dial. Output is via banana screw sockets. See cat P114 for details.

Cat. MP-3035

Was $49.95 Save $10 **Now $39.95**

Key Ring Laser Pointer

•3 x LR44 batteries (supplied).
•Max output: < 1mW

Cat. ST-3102

$12.95

DELUXE STEREO MINIPHONES

Are your portable Tape or CD players earphone looking a bit worse for wear, these quality built stereo earphones feature an in-line volume control and handy storage case. See catalogue page 227 for details.

Cat. AA-2017

Was $19.95 Save $5 **Now $14.95**

VOICE ACTIVATED RADIO HEADSET

This headset is designed to suit YAESU, ICOM, ALINCO, and STANDARD transceivers and is about half the price of most other types which don't have a VOX function. See cat page 226 for details.

Cat. AA-2030

Was $51.95 Save $12 **Now $39.95**

ULTIMATE AUTO SOUND

Save $10

This 99 page book is a must for sound enthusiasts who are serious about the quality of sound in their car, van, truck, etc. Fully illustrated with easy to follow diagrams and lots of great advice.

Cat. BA-1412

Was $24.75 **Now $14.95**

LIMITED QUANTITY AVAILABLE

350WRMS ACTIVE SUBWOOFER AMPLIFIER

Save $30

This amplifier module will produce a hefty 350WRMS into 4ohms or 240WRMS into 8ohms and features a remote control unit, phase control, variable x, over point (50-160Hz), hi and low level inputs, and auto power on/off. See catalogue page 219 for details.

Cat. AA-0506 **Was $429** **NOW $399**

SUPER TORQUE RATCHET BIT DRIVER

$13.95

Swivel action gives the ratchet handle a range of angles. Includes a comfortable, non-slip, soft grip handle. The ratchet accepts standard 1/4" bits and is an ideal companion for our 'Full House' bit set range. See cat P45 for details. Cat. TD-2033

NEW LIGHTING AND PARTY LIGHTING

20W 12VDC FLUORO LIGHT NEW

This attractive, high quality fluorescent light fitting is supplied with a standard 24 inch 20 watt tube which is protected by a clear acrylic cover. The unit has a retractable carry handle for portable use or it can be wall mounted for fixed installations. Operates from 12VDC & includes on/off switch.

Size is 95W x 75H x 680Lmm. 520mA. **Cat. ST-3060**

$59.95

40W 12VDC FLUORO LIGHT NEW

$79.95

Attractive, high quality fluorescent light fitting accepts 2 standard 24 inch 20 watt tubes, protected by a clear acrylic cover. Designed for fixed installations and operates from 12VDC. Size is 140 (W) x 75 (H) x 830 (L)mm. 1 tube 490mA/2 tubes 980mA. **Cat. ST-3062**

COMPACT FLOURO BLACK LIGHTS

15 Watt

2 Volt, equivaient to a 70W standard globe. Cat. SL-3154

$23.95

26 Watt

3V, equivalent to a 120W standard globe. Cat. SL-3156

$32.95

LIGHTING STAND

This strong and sturdy lighting stand will extend from 1530mm to 3650mm tall and carry support a weight of up to 20kgs. See catalogue page 251 for details.

Cat. CL-2800

$119

BUY THE LIGHTING STAND THIS MONTH AND RECEIVE 3 LIGHT CLAMPS FREE
3 x Cat. SL-2959 Value $26.85

3 WAY LINKABLE LIGHT

$129

This modular lighting system can be set to respond to ambient music levels. Can control up to 6 linkable modules. Extra light modules SL-2952. See catalogue page 250 for details. **Cat. SL-2950**

Buy the 3 way linkable lights along with 3 extra light modules For $196.50 & receive the 3 extra globes valued at $23.40 free.

MINI LINKLAMP PARTY LIGHT

This linklamps set is made up of 6 different coloured globes featuring special metal filament bulbs. Complete unit measures 250(W) x 240(H) x 75(D) mm. See catalogue page 252 for details.

Cat. SL-2992 Was $79.50

Save $15 **NOW $64.50**

PAR56 BLACK CAN LIGHT

This huge can light features an adjustable mounting bracket and quick change gel-film holder. See cat P251 for details.

Cat. SL-2975

Was $79.95 Save $10 **NOW $69.95**

OVERNIGHT DELIVERY

MAILORDERS - FREECALL FOR PHONE ORDERS - 1800 022 888

OVERNIGHT DELIVERY

6.5" SPLIT SYSTEM

Normally these are a great price at $79.50. 50 -60 WRMS.
Cat. CS-2292
Was $79.50Pr
Save $20
Now $59.50pr

6.5" SPLIT SYSTEM

High quality system.
See Cat. page 239.
CS-2294
Was $189
Save $20
Now $169pr

DOUBLE MAGNET SUBS

Hot 4's loved the 12". See their comments in our catalogue. Dual voice coils, die cast basket.

RESPONSE

10" Cat. CS-2226
Was $249
Save $30
Now $219

12" Cat. CS-2228
Was $289
Save $20
Now $269

SPEAKER GRILLS - PRICES SLASHED

PRICES SLASHED

Cat.	Size	Was	Now	Save
AX-3518	6.5"	$6.95	$4.95	$2
AX-3520	8"	$6.95	$4.95	$2
AX-3522	10"	$9.20	$5.95	$3.25
AX-3524	12"	$10.50	$6.50	$4
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SC March, 2001
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SERVICEMAN'S LOG

From here, there and everywhere

This month, I'm taking a break from my own workshop and presenting three servicing stories sent in by readers. They cover repairs to two colour TV sets and an elderly VCR with lots of problems.

Let's get straight into it. The first contribution comes from Mr R. H. of Carine, Western Australia and he's called it "A Sad Repair Story." I'll let him tell it in his own words:

It concerns a Sharp CX3451 colour TV set which an elderly relative had imposed on me to repair, after she could not get a response from two repair shops advertising in the local newspaper.

My main business involves the repair of switchmode power supplies and other industrial electronics equipment and generally I shy away from domestic appliance repairs. I find that, in most cases, the time spent is much greater than one can legitimately charge a customer and even if you do charge a modest amount, you are still accused of overcharging.

So to my story. The set was working but could be induced to lose the picture, with the screen collapsing to a horizontal line, by tapping on the outside of the case. My thoughts were that it was obviously a loose connection or a faulty joint problem and that it shouldn't take too long to find. I discharged the tube before removing the EHT lead and it was a simple matter to remove the main board.

I thoroughly inspected the board with a magnifying lamp but for the life of me, I could not detect a connection or soldered joint which I could honestly say would cause the symptom – and I have had many years experience in locating this type of fault. There have not been more than a few cases where I could not pick a faulty joint by visual inspection but the symptoms indicated that there was almost certainly one here.

I decided to try the shotgun approach and resolder all the most likely suspects but as I later discovered, this only caused the real fault to temporarily disappear. Anyway, having completed the resoldering, I put everything back together and could not get the set to falter when I gave the case a solid tap, so I took it back to my relative. No sooner had I fired it up than there was the same fault back again.

I took it home and decided to get the board operating out of the case. However, the leads from the degaussing coil were too short to allow this, so I decided to remove the tube as well and connect everything up on the floor. I arranged the tube with some soft wedges to keep it upright and when all was ready I fired it up.

I went around the suspect area of

Items Covered This Month

- Sharp CX3451 TV set.
- Sharp VC-90ET VCR.
- Philips 14CF1014 portable TV set.

EVEN IF YOU DO CHARGE A MODEST AMOUNT, YOU ARE STILL ACCUSED OF OVERCHARGING

the board, tapping it gently with a plastic toothbrush handle, and found that I could induce the fault reliably with the gentlest of touches in a fairly small area. I thoroughly re-soldered every joint in a diameter of 75mm and this time, I was unable to induce the fault when the board was tapped. I had fixed the fault for sure but this was not the end of the story.

During the time the whole box and dice was set up on the floor, I had forgotten to reconnect the lead which connects the aquadag of the tube to the 0V rail on the PC board and the tube was thus sitting several thousand volts above chassis. Unfortunately, due to the very short degaussing coil leads, the aquadag finished up within a couple of millimetres of the metal casing housing the infrared receiver module.

I remembered I had heard a spark jump while tapping the board and looking for the original fault but I had not actually seen it. Since it appeared to have had no effect on the picture or the manual operation of the set using the front panel controls, I concluded it was of no consequence. I didn't have the remote control unit with me anyway so I couldn't check it out.

At this stage, I decided to put it all together and deliver it once again to my relative who was pleased as punch when I demonstrated that the original fault was now fixed. However, shortly after arriving home, I received a phone call from my relative to tell me that the remote control was not working.

Uh-oh, I thought, maybe that spark was telling me something after all. I decided to leave it until the next day and work on it then. I suspected that the IR module was dead and hoped that that was all there was to it.

I removed the module (a Sharp GP1U5 IR receiver), connected it to a 5V supply and connected a CRO to the output. Sure enough, the module was self-triggering in an erratic manner without any signal being received. I checked the Sharp parts supplier and he had a unit in stock at around $16. I thought this was rather high, so I decided to try the Tandy GP1U5 copy (276-0137) at $3.90. This Tandy unit was a vertical mount model but I was able to remove the internal PC board, change the connection pins and then remount it in the horizontal casing from the original unit.

This unit worked perfectly when tested on the bench, the unit responding to the remote control with a no-load output signal of around 5V p-p. I then refitted the module to the main PC board, connected everything together and gave it a try. It did not respond to the remote control so out it came again.

Next, I decided to just try the board without connecting the tube but in order to do this safely it was first necessary to remove the horizontal output transistor to prevent the EHT zapping anything.

I connected the CRO to the output of the IR module and when the remote was operated, the signal amplitude was only around 400mV p-p. This was insufficient to drive anything in the 54-pin Sharp IX1703CEZZ IC. Desoldering pin 46 on this IC and checking with a diode tester showed that the internal protection zener on this input measured high leakage in the reverse direction, thus indicating it was indeed zapped.

A new IC from Sharp was going to cost $43.50 (ouch!) and would take several days to obtain from Sydney. It seems that my small oversight in not connecting that chassis lead had accidentally led to both the IR module and the function control IC taking a direct hit and thus resulting in my good deed for my relative costing more than anticipated.

Multi-standard VCR

The next contribution comes from Mr A. B. of Glen Waverley, Victoria. He calls it " The (more than) Multi-Standard VCR."

The machine in question was an elderly Sharp VC-90ET VCR, a top-of-the-line, multi-standard unit that does everything. It has stereo hifi, will record/playback NTSC, SECAM & PAL (all at a bewildering variety of chroma frequencies), and features standard play and long play. All-in-all, a very fine machine.

It was, alas, somewhat sick, hence

its arrival at my workshop. The owner brought it in saying "you were recommended by my neighbour, you fixed up her 78 RPM gramophone." This set me back somewhat; I know I've been fixing things for a while but I am not that ancient! Actually, it was an old Garrard turntable that I'd repaired, so that some vintage jazz 78s could be copied onto tape but that's another story.

The Sharp VCR was not well – the front panel display was very dim, the mechanism was making horrible grinding noises, it was chewing tapes and the audio was shocking. As well, there was some patterning on the received off-air picture.

This latter problem was tackled first. This VCR, like most modern machines, has an RF output in the UHF band and this needed to be checked. To do this, the test switch on the back of the set was turned on and the workshop TV set put into search mode until the two white tuning bars were found. The test switch was then set to "Off" and the poor picture revealed.

When the VCR operate switch was turned off, the monitor screen produced a faint Ch31 picture – ie, classic co-channel interference. By using a small screwdriver, I was able to adjust the RF output clear of the occupied channel and a good picture came up.

Next, a dummy tape was inserted and the machine put through its paces. Fast forward and rewind (FF/REW) were horrible – the capstan motor obviously had dry bearings (a common problem) and a squirt of CRC 226 gave a temporary cure, pending a proper motor strip down and clean/lubricate.

The PLAY mode was then selected and this started the head drum and moved the tape guides into position, as expected. I then pressed the EJECT button. The cassette ejected OK but the guides hadn't retracted, which meant that the tape hadn't unlaced. Little wonder it was chewing up tapes.

This sequence was repeated a few times and there were variations – sometimes it would work perfectly, sometimes the head drum wouldn't start and sometimes it displayed the original behaviour. This indicated an intermittent mode switch so it was removed and cleaned, which cured this fault. As well, during all these repairs, the relevant drive and loading belts were progressively replaced.

The sub-loading arm was also very stiff (this manifests itself as no – or erratic – tape counter) and so this was also sprayed with CRC 226.

The final mechanical problem was poor rewind, especially the last few minutes of a tape (or the first few minutes if playing from the beginning of the tape). The cure for this is to disconnect power, remove the cassette cradle, and manually rotate the loading motor until all arms, etc are clear of the take-up reel. This is then removed, the dust, etc cleaned out from underneath, the soft brake pads deglazed from the two brake arms and the rotation sensor cleaned. It sounds complicated but it's easy after you've done it a few hundred times!

As a final step, the worn (glazed) pinch roller was replaced and the heads (ie, audio/video/control/erase) cleaned. We now had a mechanically functioning VCR.

The next step was to repair the front panel display. This problem was traced to multiple faulty and out of tolerance capacitors in the power supply module – again, so far so good and I now had a nice bright readable display.

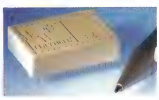
The last (and most perplexing) fault involved a number of audio problems. The VCR was connected to the workshop stereo amplifier and speakers, and a stereo test tape run. This resulted in the classic "chuff chuff " sound of an FM carrier dropping in and out. My first thought was worn audio heads – very rare on Sharp machines but not unknown.

The pins from the head drum were desoldered and the Q of the heads measured – they were still excellent and more to the point, both heads were very close to the same reading. This ruled out worn/damaged heads. A further test at this stage is to select PLAY and listen – with the stereo heads physically disconnected, the machine should default to mono audio and any FM noise should disappear. As well, the front panel level meter should show a mono signal.

This wasn't happening; there was still heaps of noise and the level meters were showing stereo L and R – not possible! As well, it was now observed that there was FM white noise coming through with the mono signal on the monitor. I resoldered the heads in disgust and wandered off for a cup of tea and a good think!

The machine had been left running

The Tiger comes to Australia

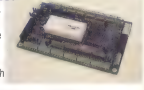


The BASIC, Tiny and Economy Tigers are sold in Australia by JED, with W98/NT software and local single board systems.

Tigers are modules running true compiled multi-tasking BASIC in a 16/32 bit core, with typically 512K bytes of FLASH (program and data) memory and 32/128/512 K bytes of RAM. The **Tiny Tiger** has four, 10 bit analog ins, lots of digital I/O, two UARTs, SPI, I²C, 1-wire, RTC and has low cost W98/NT compile, debug and download software.

JED makes four Australian boards with up to 64 screw-terminal I/O, more UARTs & LCD/keyboard support. See JED's www site for data.

TIG505 Single Board Computer



The TIG505 is an Australian SBC using the TCN1/4 or TCN4/4 Tiger processor with 512K FLASH and 128/512K RAM. It has 50 I/O lines, 2 RS232/485 ports, SPI, RTC, LCD, 4 ADC, 4 (opt.) DAC, and DataFLASH memory expansion. Various Xilinx FPGAs can add 3x 32bit quad shaft encoder, X10 or counter/timer functions. See www site for data.

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Also available is a multi-PROM UV eraser with timer, and a 32/32 PLCC converter.

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while the cup of tea was organised and, while idly sitting with the brain in neutral, I suddenly realised that there was modulation coming through the stereo speakers but that it wasn't from the tape – it was from a local AM broadcast station! I traced out the audio lead from the head amplifier pack and noticed that just wrapping my fingers around the connector where it entered the audio processing board was enough to remove the interference. This was obviously not a long-term solution unless I was prepared to move in with the customers!

The connecting lead was removed and the continuity of signal conductors and earth screening was checked – all OK. What now? – the thing looked like it was functioning as designed and the manufacturer had provided proper screening of the low level signal leads. And then I suddenly thought of the junk pile at the back of the workshop.

I had scrapped a whole pile of monochrome IBM monitors a few years back and remembered they all had toroid formers on the signal input leads, obviously put there to suppress any noise from the computer radiating via the monitor leads. One of these was chopped off the IBM, and as luck would have it, there was a big enough hole to pass the connectors on the end of the Sharp audio lead. There was also enough cable to be able to wind two turns around the toroid. This was lashed into place with nylon cable ties and, much to my relief, the problem was cured!

A follow-up phone call a few weeks later to the customer revealed all was well and they were recommending me to all and sundry .... an ideal way to finish a job!

Faulty memory

Contribution number three comes from Mr J. R. of Deer Park, Victoria. There may be a temptation to describe it as a memory fault – but it has nothing to do with computers. Anyway, this is his story.

I'm a TV/video tech by trade but I'm now on a disability pension. I did a mature-age apprenticeship which took me through a few employers who fixed all kinds of gear, ranging from TV sets to video and audio equipment. My last job involved computer monitor repairs.

These days, I fix electronic equipment for friends. I maintain a small workshop in my 3m x 3m shed and carry a reasonable stock of passive and active spare parts, mainly for electronic projects from SILICON CHIP which I build for myself or mates.

Recently, one of my mates landed me with a Philips portable TV set Model 14CF1014 (CF-1 chassis), explaining that it was his daughter's set and that she had been complaining of funny colours. She uses this set mainly for her beloved Playstation. He also complained that, on some of the games she played, the picture would roll.

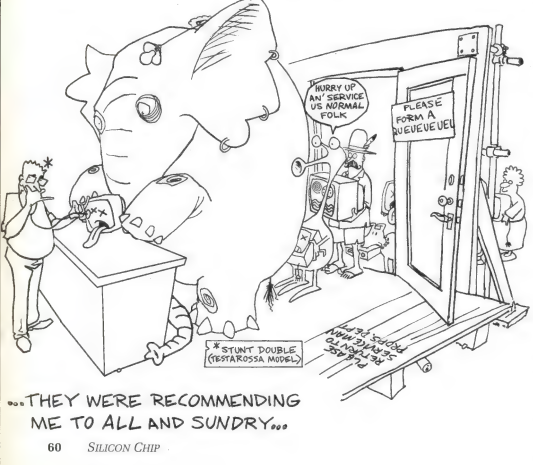
The second fault I already knew about (of which more later) and I didn't think the second would be hard to fix, so I told him it should be ready in a day or two. He urged me to fix it ASAP as, in the meantime, she would want to use his main TV set for her game playing and he'd miss out on all his favourite shows. I promised him top priority.

When I switched the set on, I found that all the colours were indeed wrong. I was watching soccer highlights and found that the grass was blue and the player's faces were green. I then switched my workshop portable on to compare the colour differences and found that a billboard which should have been green was actually red.

I'd seen this fault before many years ago in an old Princess TV set and I attributed that fault to a faulty colour processor chip. Feeling that this would also be the problem here, I attacked this section first. First, I measured all the pins on the chrominance/luminance chip, which was a TDA3560 (designated as 7192). These all measured OK so I next checked transistor 7148 (BC548), the Y signal buffer, for correct voltages. These were also spot on and capacitors 2218 (2.2µF), 2191 (1µF) and 2192 (22µF) were all within tolerance.

I next checked the 185V rail filter capacitor (3.3µF 250V) and found it to be down to only 1µF. Bingo! I replaced this with a sturdy 350V job, turned the set on and found I was back to square one; still the same mismatch. Damn – I thought I had it. I was now beginning to suspect the aforementioned TDA3560 chip. I didn't have one in stock so I ordered one from my supplier.

When the chip arrived the following day. I proceeded to fit it. But prior to that, I'd fitted an IC socket to make the job easy. Isn't



it strange how quickly one likes to know whether you were right with your diagnosis or not? After a quick fit and a turn on, I stared at the screen in disbelief. I was still seeing mixed colours. So much for blaming the chip. Where to now?

I plonked the set face down on the bench and began making some more voltage checks in the hope that I had missed something. As I was prodding, around the chroma chip, I decided to look at the picture by tilting the set up and bending down to look at the screen. To my surprise, all the colours were back to normal!

What did I do to fix it? I well remember a computer monitor that had a no-power fault but fired up when I touched my multimeter probe on a resistor in the start-up circuit. But what could I have prodded to get this set to behave normally? The answer soon came.

I switched the set off and stood it up into its correct position and fired it up. The mixed colours were back. Aha! Now I've got you! With the set still on, I then turned it face down. The colours went back to normal.

I now knew I had a purity problem, not a colour-processing fault as I originally had thought. I turned the set off, turned it back into its correct position, and went straight for the degaussing thermistor. When I pulled it out, I gave it a bit of a shake, and I could hear something rattling inside. I'd finally found the culprit.

Luckily I had one in stock and fitted it. I switched on – the picture was still a bit poor but a whole lot better than before. I brought out my magic wand and degaussed the set and that was it – a perfect picture. I did a few geometry and white balance adjustments and the set came up like new.

MY LAST JOB INVOLVED MONITOR REPAIRS...

Now I had to tackle the vertical hold problem. I removed the vertical hold adjustment – a 1MΩ trimpot (3413) – and replaced it with three wires to which I joined a large 1MΩ pot. Then I drilled a hole in the front panel (bottom right) and fitted the pot in there. They now have an external vertical hold control.

A cheaper way of doing this is to adjust the original trimpot to a centre frequency, between 50Hz and 60Hz. To do this, you need a chipped Playstation and a PAL and NTSC game. You alternate, changing between the PAL and NTSC games, while slightly adjusting the trimmer until you get no picture roll on either formats. And that's it – instant fix but I like to give friends an external control.

My friend didn't waste time picking up the set. His daughter had complained that the large 68cm TV set she had purloined for her Playstation were making all the characters look too big and she wanted her little set back.

When I think back to my apprenticeship days, I remember being told to degauss a set with gross colour problems first before condemning the electronics. Looks like I need more experience . . . or a better memory. **SC**

Personal Noise for Tinnitus

This Personal Noise Source produces pink or white noise and can be used to drive headphones or an external speaker to block out unwanted noise. It has been specifically designed for Tinnitus sufferers but can be used by anyone who wants to mask unwanted sound.

Why would you want a Personal Noise Source? Isn't there already enough noise in this world?

Well, believe us, if you suffer from Tinnitus, this Personal Noise Generator is virtually the only treatment available. It is cheap and you can do it yourself.

If you have never suffered Tinnitus, congratulations; you are fortunate. You don't know what it's like. Tinnitus is the perception of sound when no external sound is present. Commonly referred to as "ringing in the ears", Tinnitus may sound like humming, clicking, buzzing, ringing, hissing, roaring, whistling or crickets. One of the staff members of SILICON CHIP occasionally experiences it and he reports that it sounds like a tone at about 400Hz. Fortunately, in his case it rarely lasts for more than a few minutes.

Tinnitus may be intermittent or constant and may vary in loudness depending on stress, medications and the surrounding environment.

Most people who experience Tinnitus are not really bothered by it. But some people find that it seriously disturbs their sleep while others find it really debilitating.

For those people who are seriously affected, Tinnitus Retraining Therapy (TRT) can provide an effective treatment. Developed by Dr Jawel Jastreboff, TRT involves the use of low level broad band noise. TRT does not cure Tinnitus but it does make it manageable for people who are severely affected.

Want more information on Tinnitus? There is not much more to tell although there are lots of websites devoted to it. Just call up your favourite search engine (Yahoo, Google etc), type in Tinnitus and you will find lots of references.

OK, that's enough about Tinnitus for the moment. Even if you don't suffer from this affliction, there are times when a low-level noise source can be really helpful in blocking out extraneous noise.

For example, if you are trying to sleep and a nearby neighbour is having a boisterous pool party: switch on this Personal Noise Source (PNS) and you can blank it all out. Or maybe you are trying to study and someone else in the family persists in listening to a Marilyn Manson CD; again, switch on your PNS and blot it out of existence.

Another of our staff members has frogs in a fishpond, right outside his bedroom window, who play "who can make the loudest mating calls" all night (they're silent during the day, of course!). Now frogs are a protected species and our bloke doesn't want the wrath of the Government Inspector of Frogs coming down on him. Switch on the PNS and – ahh, bliss: sleep at last!

When we said the PNS blocks noise, that's not strictly true. It doesn't really block it out: it more "masks" it by increasing the ambient level so that the unwanted noise is much less obtrusive. The "noise" from the PNS is something you can live with – in fact, it is often quite soothing. It has been likened to what you hear from a soft waterfall or a stream cascading down rocks.

The Personal Noise Source is built into a small plastic case and as mentioned above, can be connected to headphones or to a small loudspeaker. It can be powered from a DC plugpack or 9V battery. It includes a volume control and can provide pink or white noise. What's the difference?

Personal Noise Source Features

- Suitable for headphone or loudspeaker
- Pink or white noise output
- Battery or plugpack operated
- Inbuilt volume control

"White" and "pink" noise

White noise has equal energy per constant bandwidth. So the 1kHz band from 1kHz to 2kHz will have the same energy level as the 1kHz band from 10kHz to 11kHz. In practice, this means that white noise has a 3dB rise in amplitude for every octave.

Pink noise has a flat frequency re-

Source Sufferers

By JOHN CLARKE

sponse or equal energy for each octave; the energy from 20Hz to 40Hz is the same as the energy from 10kHz to 20kHz. In effect, this means that pink noise sounds more subdued and less harsh than white noise. Putting it another way, pink noise has more bass and less treble than white noise.

Pink noise is also used for measuring loudspeaker systems so even if you don't need this PNS for blanking out unwanted noise it could be handy if you are involved in developing loudspeakers.

Circuit description

Fig.1 shows the circuit diagram. It comprises a white noise source (Q1), amplifier (IC1a), pink (low pass) filter and further amplification (IC1b), followed by the volume control (VR1) and power amplifier (IC2).

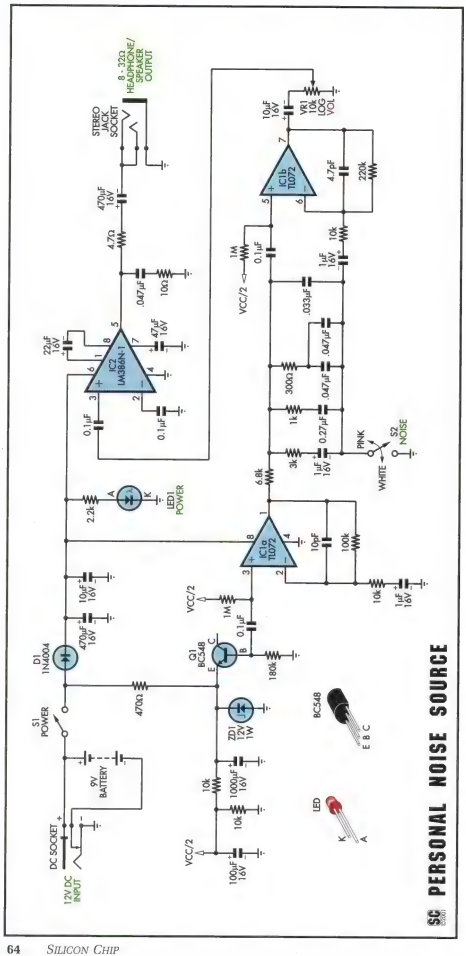
Transistor Q1 is the noise source. Its base-emitter junction is connected the "wrong way around" so that reverse current flows. Normally this could lead to breakdown of the transistor but the 180kΩ series resistor limits the breakdown current to about 30μA so no damage occurs.

Connected this way, Q1 functions like a zener diode and produces a noise signal across the 180kΩ current limiting resistor. The supply to Q1 is decoupled with a 470Ω resistor and 1000μF capacitor and a 12V zener diode regulates the voltage so that the noise level is constant regardless of changes in the supply voltage.

The noise signal is coupled to pin 3 of op amp IC1a via a 0.1μF capacitor. IC1a is set to provide a gain of 11 by virtue of the 100kΩ resistor between pins 1 and 2 and by the 10kΩ resistor in series with the 1μF capacitor. The 1μF capacitor rolls off frequencies below 16Hz while the 10pF capacitor across the 100kΩ feedback resistor rolls of frequencies above 160kHz.

Pink noise filter

The output of IC1a drives a fairly complex RC network which functions as the pink noise filter. It attenuates



the white noise at a rate of 3dB per octave. This filter is accurate to ±0.25dB from 10Hz to 40kHz, assuming close tolerance capacitors.

Switch S2 enables the pink noise filtering to be disabled to let the white noise through without attenuation.

Depending on how S2 is set, the pink or white noise is AC-coupled to pin 5 of op amp IC1b via a 0.1µF capacitor. When S2 is closed, the 220kΩ and 10kΩ feedback resistors for IC1b set the gain at 23. Low frequency rolloff is set at 16Hz with the 1µF capacitor. The 4.7pF capacitor across the 220kΩ resistor gives high frequency rolloff above 153kHz.

But not only does switch S2 determine whether or not the pink noise filter is enabled, it also changes the gain of the following op amp stage involving IC1b. When S2 is open, the negative side of the 1µF capacitor associated with a 10kΩ resistor is disconnected from ground and is effectively connected to the pin 1 output of IC1a via the pink noise filter components. This means that the output signal from IC1a is fed to both the inverting and non-inverting inputs of IC1b. The gain for the non-inverting input is 23, as noted previously, while the gain for the inverting input is -22. Adding these two gains together gives a gain of 1.

This means that the gain for the white noise signal is unity while the gain for pink noise is 23. This higher gain for pink noise compensates for the signal loss in the pink noise filter. Fig.2 shows the pink and white noise frequency response for the circuit.

The output of IC1b is AC-coupled via a 10µF capacitor to the volume control potentiometer VR1 and then AC-coupled again to an LM386 power amplifier, IC2. Its gain is set to 200 by the 22µF capacitor between pins 1 and 8. The amplifier drives the external speaker or headphone load via a 470µF capacitor and a 4.7Ω resistor. There is also a Zobel network, comprising a .047µF capacitor and a 10Ω resistor, which is included to ensure high frequency stability.

The speaker output is connected

Fig.1 (left): the reverse-biased base-emitter junction of Q1 generates the noise in this circuit. It is amplified by IC1a and IC1b and the RC network following IC1a is the pink noise filter.

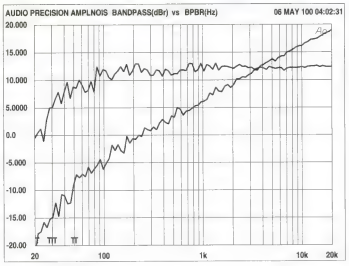


Fig.2: the pink noise output has a flat frequency response while the white noise shows a rising response with frequency.

via a 6.5mm stereo jack so that it can drive stereo headphones (with both channels commoned to provide mono mode) or a mono amplifier. The 4.7Ω resistor is series with the jack socket is included to prevent damage to the LM386 which could otherwise occur if a mono jack is inserted into the stereo output socket.

Power for the circuit is derived from a DC plugpack or 9V battery. Reverse polarity protection is provided using diode D1 which prevents reverse current into IC1 and IC2. However, the supply for Q1 is taken before the diode to allow the maximum voltage from the battery. This is important since Q1 breaks down at around 7V or so. Once the battery drops below 7V, Q1 will be no longer produce any noise and the battery will need to be replaced.

Reverse polarity protection is not strictly necessary for Q1 since it would be biased in the forward direction and the zener diode, ZD1 will conduct in the reverse direction and prevent the voltage exceeding 0.6V.

The half-supply voltage for the op amps in IC1 is set using two series connected 10kΩ resistors across the Q1 supply and is decoupled with a 100µF capacitor. The power LED is driven via a 2.2kΩ resistor while the whole supply is decoupled using a 470µF capacitor.

The DC socket connects the negative terminal of the 9V battery to ground of the circuit via an internal switch contact. The contact is opened if a DC plug is inserted, thus isolating the battery from the 12V plugpack supply.

Construction

All the parts of the Personal Noise Source are assembled onto a PC board measuring 60 x 70mm and coded 01109011. This is housed in a plastic case measuring 130 x 68 x 41mm. Fig.3 shows the PC board overlay and all the external wiring.

Begin construction by checking the PC board for shorts between tracks or any breaks in the copper tracks. The corners of the PC board should be cut out so as to clear the pillars within the box.

You can begin assembly by inserting the PC stakes followed by the links and resistors. The resistor colour codes are shown in Table 1. It is a good idea to use a digital multimeter to check each resistor value as you install it.

Next, insert and solder in the diode and zener diode, making sure that they are oriented correctly. Then insert and solder IC1 and IC2. Table 2 shows the codes you may need when installing the capacitors. The electrolytic types must be oriented correctly with the positive side placed as shown on the overlay diagram. Note that one of the 1µF electrolytics is positioned on its side as shown in the photograph. This is to allow the 9V battery to fit over this area of the PC board.

Transistor Q1 is inserted next, along with the DC socket, the 6.35mm jack socket and pot VR1. The pot can be mounted onto the PC stakes on the PC board if it is a long shaft type.

Scrape the coating off the pot body where it will be soldered to the two ground PC stakes. If you are using a pot with a short fluted shaft, mount it directly on the box lid and make the connections to the PC board with hookup wire. LED 1 needs to be mounted with its top 29mm above the PC board.

Drill holes in the end of the case for the DC power socket and 6.35mm jack

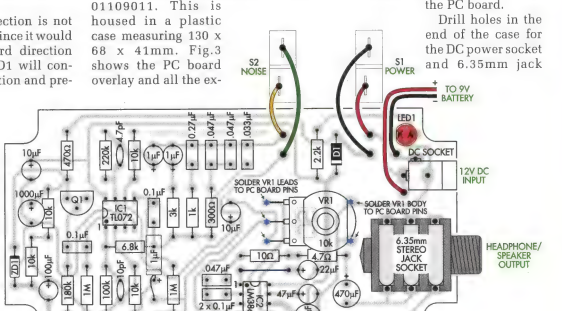


Fig.3: a stereo output jack is used to allow connection of stereo headphones. If you are using a speaker, you will need to connect it with a stereo jack plug. Do not use a mono jack otherwise it will short the output.

Parts list – Personal Noise Source

1 PC board coded 01109011, 60 x 70mm
1 plastic box, 130 x 68 x 41mm
1 front panel label, 125 x 63mm
2 SPST mini rocker switches (S1,S2; Altronics S-3202)
1 PC-mount DC panel socket with 2.5mm pin
1 10kΩ log pot (VR1)
1 PC-mount 6.35mm stereo jack socket
1 stereo 6.35mm jack plug
1 9V battery clip holder (Altronics S-5050)
1 9V battery snap
1 knob to suit VR1
11 PC stakes
1 M3 x 6mm screw and nut
1 50mm length of 0.8mm tinned copper wire
1 100mm length of light gauge figure-8 wire

Semiconductors

1 TL072 dual op amp (IC1)
1 LM386N-1 amplifier (IC2)
1 BC548 NPN transistor (Q1)
1 12V 1W zener diode (ZD1)
1 1N4004 1A diode (D1)
1 5mm red LED (LED1)

Capacitors

1 1000µF 16VW PC electrolytic
2 470µF 16VW PC electrolytic
1 100µF 16VW PC electrolytic
1 47µF 16VW PC electrolytic
2 10µF 16VW PC electrolytic
3 1µF 16VW PC electrolytic
1 0.27µF MKT polyester
4 0.1µF MKT polyester
3 .047µF MKT polyester
1 .033µF MKT polyester
1 10pF ceramic
1 4.7pF ceramic

Resistors (0.25W, 1%)

2 1MΩ	1 220kΩ	1 180kΩ
1 100kΩ	4 10kΩ	1 6.8kΩ
1 3kΩ	1 2.2kΩ	1 1kΩ
1 470Ω	1 300Ω	1 10Ω
1 4.7Ω		

Table 2: CAPACITOR CODES

Value	IEC code	EIA code
0.27uF	270n	274
0.1uF	100n	104
10pF	10p	10
4.7pF	4p7	4.7

This "opened-out" photo of the project shows the PC board and its connections to the switches on the front panel. The pot, DC and output sockets are all PC board mounting. Inset is the 9V battery holder – note the nut soldered in place.

Table 1: RESISTOR COLOUR CODES

No.	Value	4-Band Code (1%)	5-Band Code (1%)
❒ 2	1MΩ	brown black green brown	brown black black yellow brown
❒ 1	220kΩ	red red yellow brown	red red black orange brown
❒ 1	180kΩ	brown grey yellow brown	brown grey black orange brown
❒ 1	100kΩ	brown black yellow brown	brown black black orange brown
❒ 4	10kΩ	brown black orange brown	brown black black red brown
❒ 1	6.8kΩ	blue grey red brown	blue grey black brown brown
❒ 1	3kΩ	orange black red brown	orange black black brown brown
❒ 1	2.2kΩ	red red red brown	red red black brown brown
❒ 1	1kΩ	brown black red brown	brown black black brown brown
❒ 1	470Ω	yellow violet brown brown	yellow violet black black brown
❒ 1	300Ω	orange black brown brown	orange black black black brown
❒ 1	10Ω	brown black black brown	brown black black gold brown
❒ 1	4.7Ω	yellow violet gold brown	yellow violet black silver brown

socket and on the side for the battery clip screw. One of the integral PC board slots will need to be removed to allow the battery clip to sit flush with the inside of the box.

Use the front panel artwork as a guide to drilling the holes for the switches, LED and pot shaft. The cut-outs for the switches are drilled and then filed to shape. Attach the front panel label and cut out the holes in this with a sharp utility knife.

The PC board is inserted into the case with the ZD1 end going in first. The jack socket is then slid along to protrude through the end hole and is secured with its nut. Washers will be required on the jack socket inside the case.

Attach the switches to the case lid and wire them as per the wiring diagram of Fig.3. Solder the battery clip leads in place and attach the battery clip holder. We found that it is easier to first solder the nut to the inside of this clip before attempting to mount it with a screw.

Testing

You can apply power to the circuit using a 12V DC plugpack, power supply set at 12V or with a 9V battery. LED 1 should light when powered. Check that the voltage at pins 1, 3, 5 & 7 of IC1 is at half-supply. The base-emitter voltage for Q1 should be around 7V. If it is equal to the supply voltage, check that the transistor is soldered in correctly.

Note that some transistors break down above 7V and you may need to select a BC548 which has the lowest voltage across it if the PNS is to be battery-powered.

The voltage at pins 3 & 5 of IC2 should be at nominal half-supply. Connect a set of headphones or loudspeaker via the jack socket and check that there is noise available both for the white and pink settings of S2.

Current consumption at normal listening levels is around 25mA when driving a 4Ω speaker. This drops below 15mA with higher impedance headphones attached to the socket. This is OK for battery use but if you want to use it for long periods with an external speaker, a DC plugpack is the only practical approach.

Remember that the loudspeaker must be connected via a stereo jack. If you use a mono jack, the output will be shorted. SC

Here's how the whole lot goes together. The PC board snaps into place on the side guides – there are no screws to hold it in.

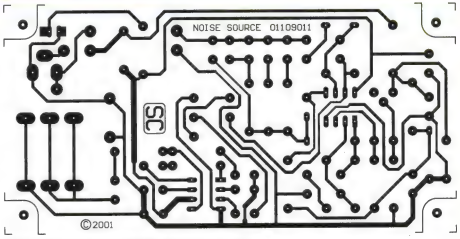


Fig.4: actual size artwork for the PC board.

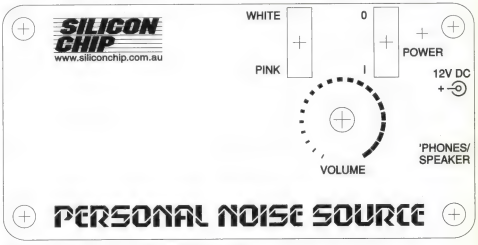


Fig.5: actual size artwork for the front panel.

CIRCUIT NOTEBOOK

Interesting circuit ideas which we have checked but not built and tested. Contributions from readers are welcome and will be paid for at standard rates.

Switchable output crystal oscillator

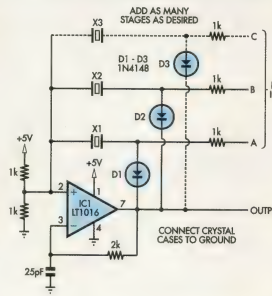
This oscillator circuit permits crystals to be electronically switched by logic commands. The circuit is best understood by initially ignoring all crystals. Furthermore, assume that all diodes are shorts and their associated 1kΩ resistors open.

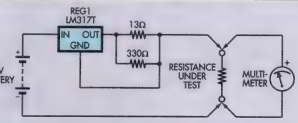
The two 1kΩ resistors at the non-inverting input of IC1 (LT1016) set the output to half the supply, ie, +2.5V. The RC network from the output to pin 3 sets up phase-shifted feedback and the circuit looks like a wide-band unity gain follower at DC.

When crystal X1 is inserted (remember, D1 is temporarily shorted) positive feedback occurs and oscillation commences at the crystal's resonant frequency.

If D1 and its 1kΩ resistor are then considered to be part of the circuit, oscillation can only continue if logic input A is biased high. Similarly, the circuit can only operate at crystal X2's frequency if logic input B is high. Additional crystal/diode/1kΩ resistor branches permit logic selection of the crystal frequency.

For AT cut crystals about a millisecond is required for the circuit output to stabilise due to the high Q factors involved. Crystal frequencies can be as high as 16MHz before propagation delays in the comparator prevent reliable operation. **Linear Technology application note.**





The circuit of the Low Ohms Adapter gives good results for such a simple circuit.

Low Ohms Adaptor for DMMs based on an LM317 regulator

This adaptor circuit is essentially a 100mA constant current source. It is applied across a low-value resistor of unknown value (ie, the resistance to be measured) and the resulting voltage drop can then be measured by a

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digital multimeter (DMM).

Setting your DMM to the 200mV range will enable it to measure up to 2Ω with high resolution while the 2V range will give a maximum resistance measurement of 20Ω.

Construction could consist of mounting the LM317 adjustable 3-terminal regulator inside a small plastic box together with the battery and two resistors connected to the output and Adj pins.

No on/off switch is required since no current will be drawn when no external resistance is connected across the Test terminals.

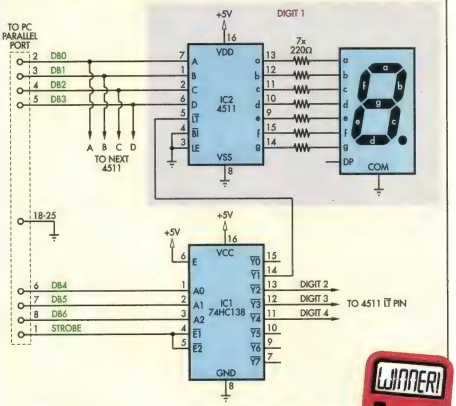
Accuracy using 1% resistors should be within 5% and this could be improved by measuring the current, adjusting the resistance between the output and Adj pins of the LM317 to provide a precise 100mA.

Before using the adaptor, check that your meter is not likely to be damaged by having the full output (6V+) applied when it is set to a low voltage range.

Similarly, be aware that the voltage and current output of the adaptor may damage components if you use it for "in-circuit" tests.

Peter Chamberlain,
Strathfield South, NSW. ($30)

LED number display uses parallel port



This circuit was developed as part of an MP3 player based on an old computer. The 2-digit display indicates which song is playing. The LED display has the advantage that it is readable from a distance compared to a 2-line LCD. The circuit could be used for other applications such as a programmable calculator, stop-watch clock or scoreboard.

The circuit uses a 74HC138 one-of-eight decoder connected to three data lines from the parallel port and a 4511 BCD to 7-segment decoder driver for each LED digit.

The software was written using Q basic but should be easily converted to other languages. This example will output a 4-digit (or less) number to the parallel port to be displayed on a 4-digit LED display:

```
CONST PPort = &H378                    'default address of parallel port (1)
Number = 1234                          'number to display
n1$ = STR$(Number)                     'convert number to string
n2$ = RIGHT$(n1$, LEN(n1$) - 1)        'remove leading blank space
FOR a = 4 TO 1 STEP -1                 'this example uses 4 digit display
IF a > LEN(n2$) THEN                   'is this digit used?
lo = 15                                'not used, blank it out (can be 0)
ELSE                                   'digit to be displayed normally
n$ = MID$(n2$, LEN(n2$) - a + 1, 1)    'get 1 digit only
lo = VAL(n$)                           'convert to byte
END IF
hi = a * 16                            'select digit to be displayed
OUT PPort, hi + lo                     'write value lo to digit hi
OUT PPort, lo                          'select digit 0 (unused) fix timing error
OUT PPort + 2, 1                       'lock display
NEXT                                   'get next
```

Philip Chugg,
Rocherlea, Tas.

CONTRIBUTE AND WIN!

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HEAR HERE! IT'S THE SOOPER SNOOPER

. . . With cat-like tread,
Upon our prey we steal:
In silence dread,
Our cautious way we feel.
No sound at all!
We never speak a word:
A fly's foot-fall
Would be distinctly heard . . .

(from The Pirates of Penzance)

Ever wanted to listen in to a quiet conversation on the other side of the street?
You can with the Sooper Snooper!

Ever wanted to listen in to bird calls without disturbing the birds?
You can with the Sooper Snooper!

Ever wanted to listen in to termites munching their way through your home?
You can with the Sooper Snooper!

Article by
Ross Tester

If all this sounds a bit hard to believe, we have to admit that we were a bit skeptical too. That is, until we tried out this amazing device. Or more correctly, two devices. That's because there are two versions of the Sooper Snooper, depending on what you want to do with it/them.

One form, the type pictured above, has a small parabolic reflector with a microphone mounted "near enough" to its focal point.

This particular Sooper Snooper is the one you would use to listen in to distant conversations, bird calls, etc – anything in the open air which would normally be too far away or too faint to hear.

The second type of Sooper Snooper is pictured above right.

It has a microphone physically connected to a "probe" which is touched against the object you want to listen to – such things as bearings inside a hard

Here's the direct connection Snooper. Both it and the Parabolic model use almost identical electronics – the main difference is the microphones and their mounting.

disk drive (see, boss, I told you my hard disk was getting old!), vehicle engine noises (it's an old-time mechanic's trick to hold a screwdriver on an engine block with the other end pushed against the ear – this one works on the same principle), you can even hear the water rushing through pipes – and much, much more.

And yes, you really **can** hear termites attacking your home and cheque book if you're unlucky enough to have an infestation!

Don't know which one would be more useful to you? Both have near-identical electronics, so you could build one and make the microphone "sensor" detachable so you could plug the other type in as required. That **would** be handy!

Best of all, the project is easy to build, low in cost and has a lot of "wow" factor. You'll amaze your family and friends – perhaps they'll be a little more careful when they're talking about you in future!!!

Oh yes, there's another feature we forgot to mention. This project can also act as an RF "sniffer" capable of detecting close-by transmitting "bugs" or other radio frequency sources in the vicinity.

You could even use it to listen in to a neighbour's CB or amateur radio transmissions (of course, it won't get the other side of the conversation). If you attach it to an outside aerial, you'll probably find every local radio station coming in at once!

So the Sooper Snooper is one versatile little project.

The electronics

The circuit is relatively straightforward, with an electret or dynamic microphone preamplifier (Q1) feeding into a "volume" pot (which, if you like, acts as a sensitivity control).

The output from the pot drives an LM386 amplifier IC which is capable of driving a speaker or pair of headphones.

You will note that there is a pair of Schottky diodes across the output for the headphones – these act as an automatic volume limiter to stop your eardrums melting if someone yells into the microphone when you're least expecting it (Schottky diodes are used because of their speed and low forward voltage).

The unit is powered by a 9V battery (although it can handle up to 15V) and has a regulated supply for the transistor preamp via the 5.6V zener diode.

Looking back to the input for a moment, there is an RF pickup (ie an antenna) which drives a voltage-doubling rectifier/detector – the output of which can be directed to the preamp via a link.

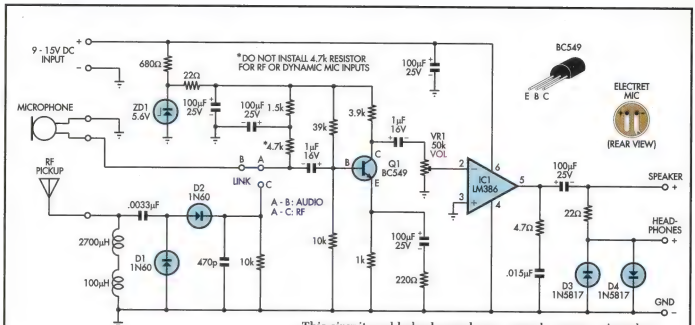
If you never plan to use the circuit as an RF sniffer, L1 and L2, D1 and D2, C1 and C2 and R12 could all be left out as they would have no function.

Two types of microphones can be used in this project.

In the parabolic model, a tiny electret insert is used to avoid "aperture blocking" of the dish. As you would no doubt know, electret microphones require a power source and in this circuit, power is derived from the 5.6V supply rail via a voltage divider and smoothing capacitor.

For the direct-pickup model, a dynamic microphone insert is used. As these require no power source, the feed resistor (4.7kΩ) is left out. The associated 1.5kΩ and 100µF capacitor have no function in this case and could be left out but its probably just as easy to leave them in, just in case you want to use an electret mic later.

In the kit from Oatley Electronics,



This circuit could also be used as a general purpose microphone preamp withVR1 made a external volume control rather than a preset pot. The two diodes across the headphone output are necessary to counter big variations in input level.

SC SOOPER SNOOPER

both types of microphone are supplied. The dynamic mic is a high quality Shure insert.

The 4.7kΩ resistor is also left out if you wish to use the circuit as an RF sniffer.

Construction

There are two parts to the construction – the electronics, which as we mentioned is basically common to both types of project, and the microphone pickups. We'll start with the electronics first.

With the obvious exception of the microphone and headphones, all components are mounted on a single PC board measuring 50 x 45 mm. The dimensions of the board are actually quite critical because it must fit a particular way into a small jiffy box, measuring 83 x 55 x 30 mm.

The board is not held in by screws; rather it sits upside-down on the ridges in the case, leaving enough room for the on/off switch underneath and the 9V battery alongside (the photos give an idea of the arrangement). Screwing the case lid on holds everything captive.

Start by assembling the PC board but first inspect it for any defects – bridges between or breaks in tracks, undrilled holes, etc. Then solder in the components, starting with the resistors (with the exception of the 4.7kΩ), then the capacitors, diodes, transistor and finally the IC.

If you need to, check the resistors with a digital multimeter and/or refer to the colour code table – just to make sure! And as always, make sure that polarized components – diodes, electrolytic capacitors, transistors and ICs – are placed the right way around.

The trimpot can be soldered in last.

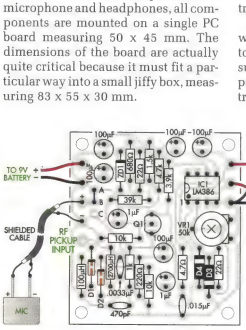
Now we turn our attention back to the 4.7kΩ resistor and the link: these depend on which version you are going to build.

If you want to build the parabolic Snooper with the electret mic, put the 4.7kΩ in. If you want to build the probe Snooper with the dynamic mic, leave the 4.7kΩ out. The link is soldered between points A and B for either "audio" Snooper or between points A and C for the "RF" Snooper.

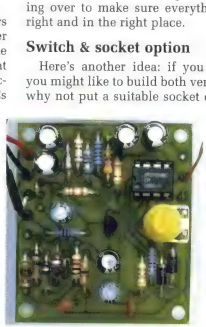
Finally, give the board a good checking over to make sure everything is right and in the right place.

Switch & socket option

Here's another idea: if you think you might like to build both versions, why not put a suitable socket on the



The PC board component overlay and the same-size photograph can be used as a quick reference guide during assembly. The link A-B should be changed to A-C for RF pickup.



case with matching plugs on the two microphone types (a 3.5mm phono plug and socket would appear perfect). Then, mount a second switch inside the case connected between the 4.7kΩ and point A. Switch the resistor "in" when you want to use the parabolic Snooper and "out" when you want to use the probe Snooper.

The headphones

The headphones are standard hifi (ie, low impedance) types. If you're using the Clarion ones from Oatley Electronics (as photographed with the kit), they attach to the PC board with the colour coding shown. Note that the wires in the cable are very fine and they also need to have a tiny amount of insulation stripped from their ends.

Incidentally, these headphones are a real bargain at seventeen bucks a pair. They are very comfy and have an inbuilt level control (on the lead). Actually, this level control is the reason they're so cheap: it has a tiny manufacturing defect which you can very easily fix in about thirty seconds with a screwdriver and a pair of pliers – a sheet which comes with the 'phones tells you how.

Once you've made the fix, you may decide they're too good for this kit and use them for your hifi system!

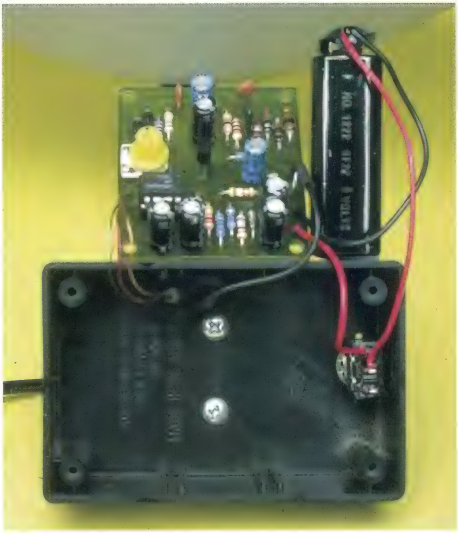
Of course, any other low impedance 'phones or earpieces should work perfectly if you happen to have some on hand. The colour coding of the cabling might be different, of course – you will have to determine which is which yourself. Then again, it doesn't really matter if you get the left and right channels mixed up – this is a mono output!

The microphone(s)

As we mentioned before there are two types of microphones usable in this project, depending on whether you want to build the parabolic (ie, long range) model or the direct pick-up model.

The Parabola

Before we describe how we made the parabolic Snooper, a word of warning. The parabolic dishes from Oatley are disposals types which were intended for a small solar cooker. They do this by concentrating the sun's rays at the focal point – and it's easily hot enough to set fire to paper/boil water/cook food/damage your eyes/cook you!

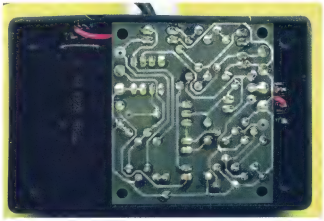


The parabolic version electronics "folded out" of their mounting box. The two large screws in the bottom of the box hold the handle onto the box.

If you take the parabolic dish outside without having painted it a matte grey (as shown in our photos) BE CAREFUL. While your head will block most of the sun's rays, there could still be enough to do you serious mischief! So before you do anything, spray the aluminium parabolic dish with matte grey paint.

OK, back to the Snooper electronics. Sound reflected back from the parabola is picked up by a tiny electret microphone insert (ie, the "works" from a microphone) mounted somewhere near the parabola's focal point.

When we say "somewhere near" we mean it: you don't have to be all



And this is what the box looks like complete. The PC board is held in place on the integral mounting lugs on the side walls of the box. There's just enough room for the 9V battery. It's tight, but it all fits!

that accurate for the unit to work very well indeed. Of course, theory suggests it will work best when the mic is mounted right at the focal point.

In practice, we found out that you can be even a few centimetres away with little or no apparent degradation of performance.

We mounted the microphone insert on a 150mm length of that highly specialized construction material we often use called "cotanger wire". This won't be supplied in the kit but if you have any difficulty finding a piece, just look in your wardrobe...

We bent the wire into a "J" shape with the mic insert mounted at the bottom end of the "J". It's not actually secured to the wire; rather, some heatshrink tubing holds it (and its fine shielded cable) onto the wire.

See the photo and you'll see the arrangement. (Heatshrink tubing is not supplied in the Oatley kit). Note that the electret mic is polarised: it must be wired as shown or it won't reward you with any sound!

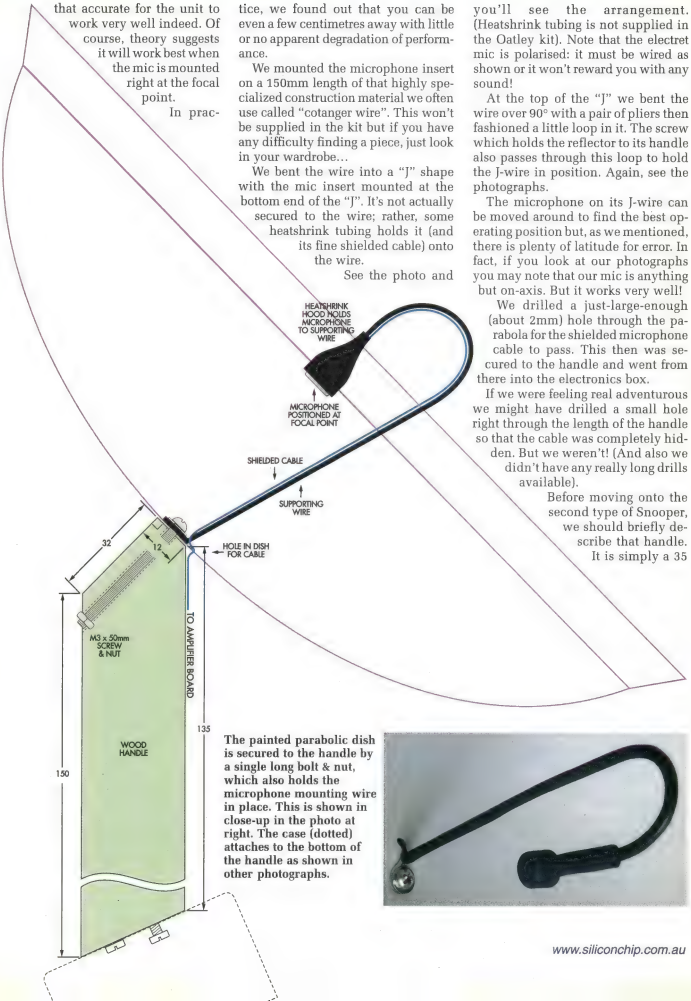
At the top of the "J" we bent the wire over 90° with a pair of pliers then fashioned a little loop in it. The screw which holds the reflector to its handle also passes through this loop to hold the J-wire in position. Again, see the photographs.

The microphone on its J-wire can be moved around to find the best operating position but, as we mentioned, there is plenty of latitude for error. In fact, if you look at our photographs you may note that our mic is anything but on-axis. But it works very well!

We drilled a just-large-enough (about 2mm) hole through the parabola for the shielded microphone cable to pass. This then was secured to the handle and went from there into the electronics box.

If we were feeling real adventurous we might have drilled a small hole right through the length of the handle so that the cable was completely hidden. But we weren't! (And also we didn't have any really long drills available).

Before moving onto the second type of Snooper, we should briefly describe that handle. It is simply a 35



The painted parabolic dish is secured to the handle by a single long bolt & nut, which also holds the microphone mounting wire in place. This is shown in close-up in the photo at right. The case (dotted) attaches to the bottom of the handle as shown in other photographs.

Looking at the Parabolic Sooper Snooper from the rear, showing how the dish is connected to the handle; the handle's connected to the case; the kneebone's connected to de thigh-bone . . .

The same photo taken straight-on: between the two pics you should get a pretty good idea of how it goes together!

Parts List – Sooper Snooper

1 9V battery
1 9V battery snap
1 SPST mini rocker switch
1 PC board, 30 x 55mm
1 case, 83 x 55 x 30mm (Altronics H-0105 or similar)
1 pair hifi headphones

Parabolic pickup:
1 electret microphone insert
1 Parabolic reflector, painted matte colour (grey)
1 60cm length stiff wire (eg, coathanger)
1 60mm M3 nut and bolt
2 M3 washers
1 wooden handle, approx 170mm long x 30mm wide x 18mm thick – see diagrams and text
1 20mm length 12mm heatshrink tubing
1 60mm length 3mm heatshrink tubing
1 100mm length shielded cable (for microphone)
Scraps of thin hookup wire (for switch connection, etc)

Direct pickup:
1 dynamic microphone insert
1 steel rod, 2mm diameter, with hard plastic handle, length around 220mm
1 2m length of shielded cable (for microphone)
Araldite or similar glue.

Semiconductors
1 LM386 audio amplifier (IC1)
1 BC549 NPN transistor (Q1)
2 1N60 germanium diodes (D1, D2)
2 1N5817 Schottky diodes (D3, D4)
1 5.6V Zener diode (ZD1)

Capacitors
5 100µF 25VW PC mounting electrolytic
2 1µF 25VW PC mounting electrolytic
1 .015µF polyester or ceramic
1 .0033µF polyester or ceramic
1 470pF ceramic

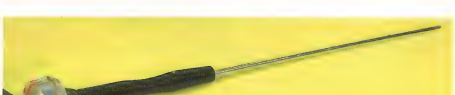
Resistors (0.25W, 1%)

1 39kΩ	2 10kΩ	1 4.7kΩ	1 3.9kΩ	1 1.5kΩ	1 1kΩ
1 680Ω	1 220Ω	2 22Ω	1 4.7Ω		

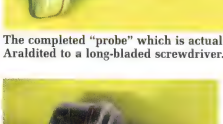
1 50kΩ preset pot, PC mounting

Resistor Colour Codes

	No.	Value	4-Band Code (1%)	5-Band Code (1%)
❑	1	39kΩ	orange white orange brown	orange white black red brown
❑	2	10kΩ	brown black orange brown	brown black black red brown
❑	1	4.7kΩ	yellow purple red brown	yellow purble black brown brown
❑	1	3.9kΩ	orange white red brown	orange white black brown brown
❑	1	1.5kΩ	brown green red brown	brown green black brown brown
❑	1	1kΩ	brown black red brown	brown black black brown brown
❑	1	680Ω	blue grey brown brown	blue grey black black brown
❑	1	220Ω	red red brown brown	red red black black brown
❑	2	22Ω	red red black brown	red red black gold brown
❑	1	4.7Ω	yellow purple gold brown	yellow purple black silver brown



The completed "probe" which is actually a dynamic microphone insert Araldited to a long-bladed screwdriver.



Here's the back end of the probe showing how the screwdriver handle was ground flat then glued to the mic insert . . .

. . . and from the opposite side, with the connections to the shielded cable which goes off to the preamp.

x 18mm (dressed) softwood, about 175mm long, cut as shown in our drawing. Both ends are cut at an angle; one end has a further cut to allow mounting of the parabola via a single long bolt and nut passing through an appropriately drilled hole.

Both handle and parabola were given a coat of grey spray paint before final assembly.

Direct pick-up model

This is considerably simpler than the previous type. All that is required is some form of pick-up which will transfer vibrations to the microphone without too much attenuation.

Our pick-up is actually a long, thin-bladed screwdriver with a hard plastic handle.

That part is important – a soft plastic would not transmit the sound vibrations as well as a hard plastic. The handle helps to stop the fingers absorbing or attenuating the sound vibrations picked up by the steel blade.

We filed the back of the handle truly flat, then simply glued the microphone insert to that flat with Araldite. Again, a hard glue ensures maximum sound transfer.

We also filed off the screwdriver head to leave a flat "pickup". This is perhaps unnecessary but it also stops anyone trying to use this as a screwdriver!

Once the Araldite dried, we simply soldered the shielded mic lead to the appropriate points on the mic insert – and that basically finishes the second type of Snooper. Remember, though, that as this is a dynamic microphone that resistor we talked about before (4.7kΩ) should be left out.

In use

If your soldering is up to scratch, you should be able to put the headphones on your head, turn the unit on – and listen. You might have to adjust VR1, the "volume" control (which in this case acts more like a sensitivity control) to get the level you want. But that's just about it.

If it doesn't work, once again check your soldering and component placement. Check that you have indeed included R4 if you made the electret version (conversely, you left it out for the dynamic version).

Otherwise, measure a few voltages: the supply, of course and 5.6V across ZD1. Check that Q1 is operating by measuring the voltage between base and emitter – it should be about 0.6V. Finally, check that there is 9V between pins 6 and 4 of IC1.

If all these are OK, perhaps it's the 'phones that are giving you curry. Unsolder them and briefly connect a 1.5V AA cell across the leads when you're not wearing them. A loud "click" means they're probably working fine.

Finally, with the 'phones back in place and VR1 set to maximum (ie, clockwise), do the "blurt" test: moisten your finger just a tad and apply it to the link connected to point "A". If you get a "blurt" from the headphones, you know the amplifier is OK – all it can be is the connections to the microphone insert. Did you forget the link from point A to point B? **SC**

Capacitor Codes

	Value	IEC Code	EIA Code
❑	.015µF	153	15n
❑	.0033µF	331	3n3
❑	470pF	470	470p

Where d'ya geddit?

This kit was designed by Oatley Electronics who hold the copyright on the design and the PC board.
Oatley Electronics have available the following kits and options:

Electronics kit: contains the PC board, all on-board components, battery snap and **both** electret and Shure dynamic mic inserts $22.00
Box kit: contains the jiffy box and on/off switch $5.00
Parabola: mill finish aluminium parabolic dish $25.00
Headphones: high quality Clarion PRO-97V stereo headphones (note – small manufacturing defect in volume control, easily fixed, repair instructions included) $17.00
Screwdriver: long screwdriver with solid plastic handle $1.00
Not supplied: 9V battery, cotanger wire, heatshrink, wood handle

Contact: Oatley Electronics, PO Box 89, Oatley NSW 2223
Phone (02) 9584 3563, Fax (02) 9584 3561
email sales@oatleyelectronics.com www.oatleyelectronics.com

Using Linux To Share An Internet Connection; Pt.4

By default, Linux is a powerful operating system that automatically configures many services (eg, a web server) straight out of the box. In this final article in our gateway series, we show you how to improve security by shutting down any services that you don't need and restricting access to those you do need.

By GREG SWAIN

You can't be too careful about security when connected to the Internet, especially if you have a network behind your Linux box. Security must be built into the gateway from the beginning, otherwise you could end up being "cracked".

Don't think that you're safe just because you are using a dial-up connection. It's quite possible for someone to find you and telnet their way into an unprotected machine in a matter of minutes.

As well as having an effective firewall, there are a couple of other things you can do to improve security. This involves shutting down any services that you don't need and restricting access to any that you do need.

Turning off services

The easiest way to deny access to a service is to turn it off. The first thing you need to do is take a look at the **/etc/inetd.conf** file (this is now **/etc/xinetd.conf** in later distributions such as Red Hat 7.0). This file lists all the Internet services started by the inetd Internet super-server daemon. You can disable any service listed in **inetd.conf** by placing a "#" (comment) at the start of the line.

For example, to disable the ftp and telnet services, edit the lines to look like this:

```
# ftp stream tcp nowait root /usr/sbin/tcpd in.ftpd -l -a
# telnet stream tcp nowait root /usr/sbin/tcpd in.telnetd
```

Note that this doesn't stop you from ftping or telneting out from your machine. Instead, it stops your Linux box from behaving as an ftp and telnet server, so that these services are no longer potential pathways into your machines. The telnet service is a real risk – make sure that you don't leave this running on an unprotected system.

In fact, if you don't need to run any Internet services, you can quite safely comment out everything in **/etc/inetd.conf**. This will still allow you to access email and

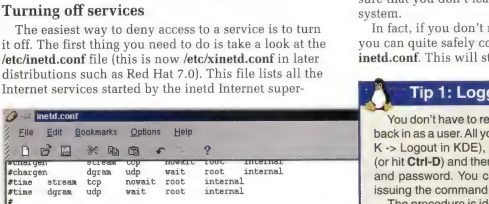


Fig.1 (left): you can turn off the services listed in /etc/inetd.conf by placing a "#" (ie, a comment) at the start of each line. Turn off all services that aren't required.

Tip 1: Logging Out & Logging In

You don't have to reboot Linux to log out as root and log back in as a user. All you have to do is quit Xwindows (click K -> Logout in KDE), type **logout** at the terminal prompt (or hit **Ctrl-D**) and then log back on using your user name and password. You can then restart KDE or Gnome by issuing the command **startx.**

The procedure is identical for logging out as a user and logging back on as root.

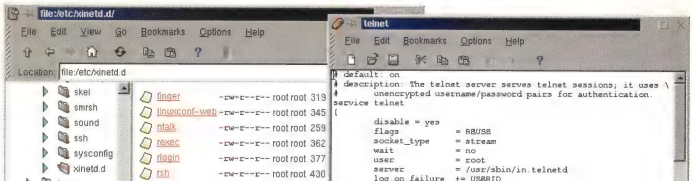


Fig.2: distributions that use *xinetd.conf* store a configuration file for each service in the */etc/xinetd.d* folder. A service is disabled by opening its configuration file and changing the *disable = no* line to *disable = yes*.

news, do all your usual web browsing and transfer ftp files.

Once you've commented out the services you don't need, you have to restart the inetd daemon with this command:

killall -HUP inetd

Recent Linux distributions that use **/etc/xinetd.conf** store one configuration file for each service in the **/etc/xinetd.d** folder. In that case, you disable a service by opening its configuration file and changing the **disable = no** line to **disable = yes** (Fig.2). You will need to do this for each service you want disabled.

When you've finished editing these files, issue the command **/sbin/service xinetd restart** to pick up the changes.

Note that many services will already be disabled by default. Note too that not all network services are started through inetd or xinetd. Instead, some are started when the system boots.

An easy way to disable (or re-enable) services is to use the **ntsysv** utility that's included in both Red Hat Linux and Mandrake Linux. Issuing the command **ntsysv** brings up the tool as shown in Fig.3 below. You use the tab and arrow keys to move around, the spacebar to select or deselect a service and the F1 key to obtain a description of the selected service.

Note that the **ntsysv** command on its own only configures your current run level. If you want to configure other run levels, then you need to include the level switch. For example, **ntsysv --level 3456** lets you configure services for run levels 3, 4, 5 & 6.

Don't turn off all the services listed by the **ntsysv** utility, as this could cause problems. Only turn off those network features that you don't need. As a rule, you can turn off telnet, wu-ftp & tftp (both FTP servers), httpd (the Apache web server) and finger (this allows remote client to identify local users).

If you don't need any of the Internet super services started by inetd or xinetd, you can disable these as well. That simple step will stop all the services launched by **inetd** or **xinetd** in one swoop (after restarting, that is).

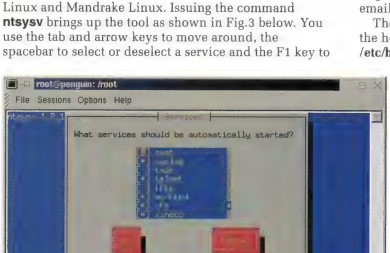


Fig.3: the ntsysv utility makes it easy to disable individual services. You can also disable multiple services by turning off inetd or xinetd.

Restricting access to services

Any services that are left running in /etc/inetd.conf can be secured by "TCP wrappers". For example, you might want to use your Linux box as a local web or email server.

The idea here is to restrict access to services based on the host's IP address. There are two files to edit here: **/etc/hosts.deny** and **/etc/hosts.allow**.

First, open up the **/etc/hosts.deny** file and add the following rule to the end of the commented section:

 # /etc/hosts.deny
ALL: ALL

This tells the "TCP wrappers" to deny connections to all services from all hosts. It will also stop local machines on your network from accessing any wanted services, so we need to weaken the rules by adding some exceptions to **/etc/hosts.allow**. Open this file and add these lines:

 # /etc/hosts.allow
ALL: 127.0.0.1
ALL: 192.168.0.

This tells the "TCP wrappers" to allow connections to the services in **/etc/inetd.conf** from the local machine (127.0.0.1) and from the

Check These Websites For Firewall Tools & Linux Security

Security really is a big subject and we've only covered the basics in this series. If you want to find out more, point your web browser to: **http://www.linuxfirewall.org**

Included on this website are a number of firewall tools that you can use to create your own ipchain rules. In particular, take a look at **PMFirewall** and the **Firewall Design Tool**. These are both script files that ask you a series of questions and then create firewall rules based on your answers.

Other tools worth looking at are **Kfirewall 0.4.2** (which is a GUI front end for ipchains) and **Gnome-Lokkit 0.43**.

Another good Linux security website is located at: **http://www.linux-firewall-tools.com/linux**. Be sure to check the **Firewall & LAN Security FAQ** on this site.

An excellent text on Linux security and other topics is ***Securing & Optimizing Linux: RedHat Edition***. This publication includes an ipchains firewall and is available for free download from: **www.linuxdoc.org/LDP/solrhe.**

The ***Linux Network Administrators Guide, 2nd Edition*** is another excellent reference on security and firewalls (both ipchains and iptables). You can download it from: **www.ibiblio.org/pub/Linux/docs/linux-doc-project/nag2**

What about iptables?

Recent distributions of Linux (eg, RedHat 7.0 and later) include a replacement for **ipchains** called **iptables** – although ipchains is still included and you can still run the ipchains firewall. The very latest releases, however, don't have ipchains compiled into the kernel but generally include it as a loadable module. In that case, try adding the following lines at the very beginning of the ***rc.firewall*** script (we haven't tested this, by the way):

```
# Load ipchains module
/sbin/modprobe ipchains
```

Alternatively, you could use an iptables firewall script. The following two websites list iptables firewalls: **www.spodzone.org.uk/packages/secure/iptables.sh** **www.amber.co.uk/iptablesrc**

The ***Linux Network Administrators Guide, 2nd Edition*** also includes an iptables firewall.

Don't Take Security For Granted

For the home user, running the simple ipchains firewall from the June issue and turning off all external services makes for a fairly secure system. Just keep an eye on the log files for any untoward activity and you should be OK.

That said, we don't offer any guarantees – the net is not a safe place! If security is vital to your organisation, be sure to seek expert professional advice when it comes to setting up a firewall. Don't just rely on the advice given in our articles.

It's also vital that you install the latest updates and security fixes, to prevent a hacker from taking advantage of a known security hole. You can get these from your distribution's website (eg, **www.redhat.com**) or by visiting **www.securityfocus.com**

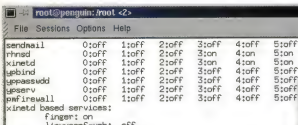
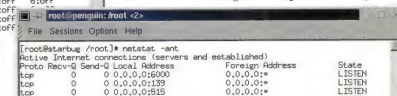


Fig.4 (left): chkconfig --list lets you quickly check which services are running.

Fig.5 (below): the netstat utility shows which services are listening for TCP packets.



local network (192.168.0.). And yes, you must include the full stop at the end of the second line.

Finding out what's running!

You can quickly find out what services are running using the command **chkconfig --list**. This begins by listing all the system services and their run levels, then lists the services managed by **xinetd** (see Fig.4).

You can also use chkconfig to turn a service off. For example, **chkconfig --level 345 xinetd off** turns **xinetd** off at run levels 3, 4 and 5. You will have to reboot for the change to take effect.

Another handy tool is the **netstat** utility. This is used to show which services are listening for TCP packets. Typing **netstat -ant**, for example, gives a response as shown in Fig.5. In this case, ports 6000, 139, 515, 22, etc are listening and you can find out which services these correspond to by looking in **/etc/services**.

Finally, you should check out the "Firewall And Proxy Server Howto", along with these two documents: (1) "Controlling Access To Services" from **www.polarhome.com/service/manual/RedHat/s1-sysadmin-access**; and (2) "Securing Your Net Connection" from **www.noether.freeserve.co.uk/secure** SC

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03-01

VINTAGE RADIO

By RODNEY CHAMPNESS, VK3UG

Healing R401E/S401E Mantle Radio

A. G. Healing of Melbourne made radios and TV sets for many years. They varied from quite simple units to reasonably elaborate ones. They never appeared to strive for the top end of the market, being content to stick with good, middle of the market equipment.

The 401E 4-valver is a basic little mantel receiver designed for areas where signals are reasonably strong. It is quite an attractive little unit in a brown Bakelite case, with the speaker grille on the left and the dial on the right. The dial has "Golden Voice" in its centre which was part of Healing's trademark. It has two controls, volume and tuning. It has no on/off switch, the wall switch being required to do the job.

It could be considered a miniature mantle receiver, although some sets of the era (1948) were smaller. The above-chassis view is filled with components, except for the power transformer and rectifier valve which are recessed below the chassis. It appears that provision was made to have a card type cover for the back, for other sets using this cabinet. This model apparently didn't have a back, as the spots where the cover would have attached to the cabinet had never been drilled to take securing screws.

Consequently, the set is easily removed from its cabinet, by undoing two screws along the bottom edge of the chassis at the back and taking the two knobs off. The set is then slid out of the cabinet but like many small radios, the dial scale and speaker remain in the cabinet. This makes it awkward so I lengthened the speaker leads, so that I could more easily service the set without having to remove the speaker from the cabinet.

The dial light is also attached to the cabinet via a slip-in socket but it is easily removed. For a long life, the dial light runs from a 4.5V tap on the 6.3V filament winding of the power transformer. One interesting little point – there is a spigot protruding from the inside of the front of the cabinet that acts as a locating pin for the chassis. It stops the chassis from moving around inside the cabinet, seeing as it is only held in place by two screws at the back.

The dial drive consists of a drum driven from a rubber grommet drive via dial cord. The grommet is a tight fit over the brass tuning shaft. The dial drum is a gold colour and there is a straight black line painted across it to act as the "pointer". This is elegantly simple and works very effectively.

The two operational controls are fitted the opposite way to normal, with the tuning control on the left and the volume control on the right. They could easily be swapped around, and maybe some sets were built with the controls arranged in the conventional manner.

I am not a fan of deep chassis construction such as this example. Relatively speaking, it is not too deep at 55mm but being a narrow chassis, care

The simple design of this Healing set extended to the gold-painted dial drum with the pointer printed directly onto it.

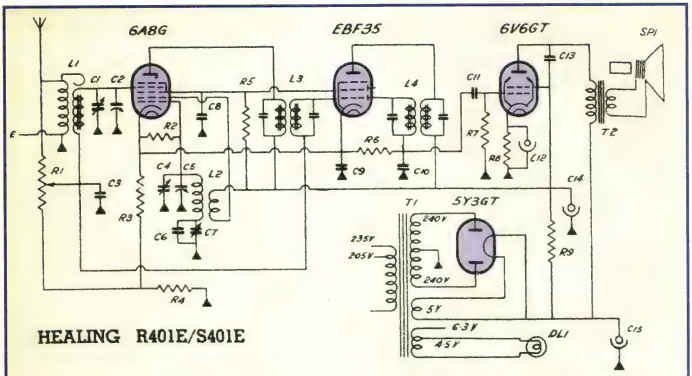


Fig.1: simplicity is the keynote of this 4-valve superhet made by A. G. Healing. Not shown on this circuit is the filter choke which has its frame connected to the HT rail.

is needed in accessing some points. Some manufacturers seemed to believe that a deep chassis gave them the right to put layer upon layer of components in, just to keep things nice and compact. Pity the poor person who had to service the sets.

Hot filter choke

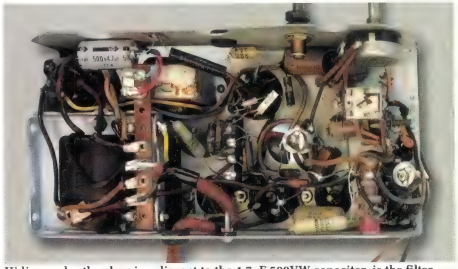
The filter choke is hidden underneath the chassis and just as well. It is mounted on an insulated fibre board and its frame is connected to the high tension (HT) line. This was done to minimise the voltage between the winding and the frame. This technique was used to help prevent electrolysis eating through the winding at some spot. Speaker transformers of this era were quite prone to the primary winding going open circuit and were often mounted so that the transformer frame was at HT too. However, this is the first time I've seen it used with a filter choke. The circuit shown has a dropping resistor instead of a choke, so it would appear that various modifications were done to the model throughout its production life.

Servicing the 401E

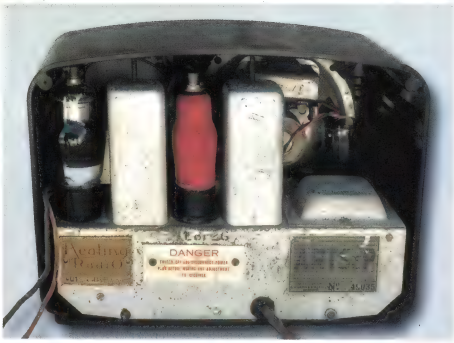
Being such a simple receiver, it is not hard to get it up and running. Most paper capacitors were replaced as they were most likely leaky. The only ones I considered essential to replace were C3, C11 and C13. However, the circuit is remarkably tolerant of slightly leaky capacitors in all locations. This cannot be said of many other receivers. All resistors bar one were within tolerance. The electrolytic capacitors were changed and a new 3-core power cord was fitted and a clamp attached to secure it in place.

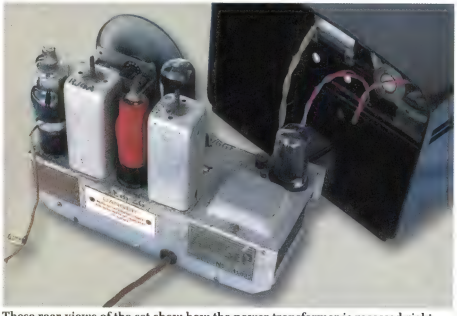
Knotting the power cable to prevent it being pulled out of the chassis is not an approved method these days. So if you do replace a mains cable, clamp it to the chassis with a metal or plastic clamp; it keeps the authorities happier.

Having replaced the components most likely to give trouble (paper capacitors in particular), a resistor and the mains cord to the set, it was time to give it a go. I went through my



Hiding under the chassis, adjacent to the 4.7μF 500VW capacitor, is the filter choke with its frame tied to the HT. This could give a nasty shock to the unsuspecting repairer.





These rear views of the set show how the power transformer is recessed right into the deep chassis.

usual procedure of checking for any shorts in the power transformer, across the high tension line to earth and that the speaker transformer had continuity in the primary winding. All was well.

Power was connected and the set warmed up but its performance was not good. I do have a few replacement valves and by the nature of the problem and measurement of the cathode to earth voltage on the 6V6GT, it was obvious all was not well. The voltage was not the designed 12V, so a replacement was tried. The set then sounded a lot healthier. Other than the alignment nothing else needed attention.

Alignment

The set is quite easily aligned. As the circuit has no automatic gain control (AGC), all adjustments can be done for maximum volume out of the speaker, provided you have a signal generator. If you have no signal generator, the best method is to connect a digital multimeter (DMM), set to a low voltage DC range, across R6 the detector load. A normal analog (moving coil) multimeter will unfortunately load the circuit too much and the readings are not likely to deflect the pointer sufficiently up the scale.

Connect a reasonable aerial to the set. Tune to a strong radio station and with a small screwdriver, adjust the primary and secondary windings of the IF transformers L3 and L4 for maximum reading on the meter. The volume control setting will affect the readings on the meter. You may not have the IF tuned to 455kHz but it should be close unless someone has been twiddling the adjustments. This is the easy part of the job.

The alignment of the oscillator and aerial circuits is a little more complex. Place the chassis back into the cabinet and make sure that when the gang is closed, the black pointer line lines up square through the Healing name. If it doesn't, adjust the drum on the gang spindle until it does. With the set in the cabinet, tune to a strong station that you know around 600kHz. If you are fortunate, the station will come in on the appropriate station marker on the dial. If not, put the dial on the station mark on the dial and withdraw the chassis from the cabinet.

Now adjust C7 until the station coincides with the dial marking. All being well, you'll be able to get the station tuned in accurately. Then adjust the core in L1 for maximum reading on the meter.

The next step is to tune to a station around 1500kHz that you can easily recognise and once again, having identified the station, turn the dial until the correct station identification has the dial pointer behind it. Note: a few years ago, some stations changed their frequencies and the markings on the dial may not be anywhere near where they were in times gone by. For example, 3NE moved from 1600kHz to 1566kHz, so older dial scales are no longer accurate.

Leave the dial pointer coinciding with the station dial marking. Adjust C4 to hear the station, then adjust C1 for maximum volume and meter reading.

The adjustments of the aerial and oscillator circuits interact with one another from one end of the dial to the other. Hence it will be necessary to go over the adjustments a couple of times to get the alignment as close as is practical. Having to slide the chassis

Photo Gallery: Astor OZ "Mickey Mouse"

Manufactured by Radio Corporation Pty Ltd in 1934, the Astor Model OZ "Mickey Mouse" was housed in an attractive veneered wooden cabinet and was the first of a long series of small sets to carry the "Mickey Mouse" and, later, "Mickey" name. The circuit was a straight 5-valve superheterodyne with an IF (intermediate frequency) of 455kHz and included the following valves: 6A7 frequency changer; 6D6 IF amplifier; 6B7 detector, AVC rectifier and audio amplifier; 43 audio output stage; and 25Z5 rectifier. The set was fitted with a 5-inch electrodynamic loudspeaker. A feature of this unit is its low HT voltage – just 130V – hence the choice of a type 43 output valve. This gave cooler running in the small cabinet.

Photo Gallery: Astor "Mickey Grand"

Manufactured by Radio Corporation Pty Ltd in 1935, the Astor Model MZ "Mickey Grand" was housed in an attractive mini-console cabinet measuring just 380mm high. It used the same basic 5-valve superheterodyne chassis as the "Mickey Mouse" but was fitted with a larger loudspeaker (6-inch vs. 5-inch). As with the "Mickey Mouse", this set also operated with an IF of 455kHz and a HT voltage of just 130V.

in and out of the cabinet to do this job is a real drag, but there is no alternative when the dial scale is attached to the cabinet.

Once this procedure has been completed, it is desirable to seal the cores and trimmer screws with some plastic cement or nail polish to stop them shifting out of adjustment.

If the tuned circuit adjustments have been completely maladjusted, it is unlikely that this simple method will achieve the results necessary to get optimum performance out of the set.

In fact, if the alignment is way off, you may not be able to hear any signals from the set. This can be compounded if there are defective valves in the set too.

How does it operate

The performance of small 4-valve radios is never expected to be marvellous. However, many do surprise me and the performance of this little set is very good, rivalling a number of 5-valve sets. Obviously, Healing got the design of their coils and IF transformers close to optimum, to obtain the performance it does have.

There is no AGC so it is necessary to adjust the volume control as you tune across the band, as strong stations will blast you and weak ones require the volume control to be advanced for reasonable volume. A set like this would not be good in areas where radio signals fade up and down due to this lack of AGC. However, it is designed for strong signal areas so this is probably not a great deficiency. **SC**

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WRITING ARTICLES

So you have spent countless hours developing a project and now you would like to see it published for all the world to see. Does SILICON CHIP accept articles for publication? Yes, we do. Here are some general guidelines to anyone contemplating writing articles for SILICON CHIP.

Want to write for SILICON CHIP? You do? Great. Before you start, let's give you some general guidelines which will make your job easier and will greatly increase the chances that the article will be accepted for publication.

Before you start on that great article concept, please contact us to find out whether it is of interest to the readers. We would hate it if you had put in an enormous amount of work to produce an article only to find that we reject it because it is not of sufficient interest to the readers.

There may be other reasons for rejection, of course: we might have a similar article ready or almost ready for publication – or we might have already given another person the go-ahead for a similar idea.

When you contact us, we will ask you for the general concept. If it is a project, we will want to see a circuit diagram and a brief synopsis on what it does, how it works and how much it might cost. We'd also need to know that any specialised components you have used will be available for other readers to obtain.

Perhaps you would like to submit a feature article. Again, we would like a synopsis; ie, a brief outline of the article. You can contact us by phone or mail but if you can do it by email, please do. Contact us at *silchip@siliconchip.com.au*

When emailing, please do NOT attach documents in HTML format. If you wrote your synopsis in Word or another text editor, leave it that way. Opening HTML documents simply takes extra time.

What about money? Yes, we do pay for published articles but there are conditions which we will spell out when you contact us. We generally do not commission articles. We always edit submitted articles and often end up doing substantial re-writes. The amount we have to do affects the overall payment.

Submitting the article itself

These days, we like articles to be submitted as (preferably) Word documents or .txt files on a Zip disk, CD-ROM or floppy disk, formatted for PCs. You can also email articles to us. If you do email us an article, please do it as a text file or as an attached Word file. Any Word attachments you send to us should be virus checked beforehand.

Speaking of viruses, we get a lot of them sent to us in various ways. If you need to send .exe files or zip files please make sure that you run them through the latest virus software such as Norton Anti-Virus. Contributors get very embarrassed when we subsequently inform them that they have a virus.

As a general policy we, like most companies these days, immediately delete any email that comes in with an attached .exe file unless we know (and trust!) the source.

By the way, we often find viruses in submitted material but the contributor swears on a stack of Bibles that they virus check everything. It's only after a bit of quizzing that we find they haven't updated their virus definitions or signatures for months, perhaps years. Please update regularly!

Article format

Please don't make your article look pretty. We want it in plain, unadorned text.

These days, since so many people have Microsoft Word or similar word processing software, there is a great temptation for writers to use fancy fonts and formats, dropped caps, italics, bullets, indented paragraphs, text in various colours and so on. Don't bother!

No matter how fancy your document looks, all that effort in presentation will be dumped because if we do publish it, it will be formatted to suit the magazine. So whether we like your article or not, we have no choice but to dump your formatting. We are only interested in your basic text.

For the same reasons, please do not present your article as a PDF file, a Powerpoint presentation or as files from any desktop package such as Pagemaker, Quark Express, Publisher, etc. We only have to extract the text back out again which once again will lose all your fancy formatting.

Fancy formatting also makes your article much harder to edit and you want to make our job easy, don't you?

OK, maybe you need to include some tables in your article. In that case, we will need the table format (eg, in Word) but please don't send them as Excel or database files.

All of that sounds like a lot of negatives but we really need to keep the whole process simple and that means text files or Word document files.

By the way, regardless of which word processor program you use, they all have a facility for outputting your article as a .txt file (also known as ASCII or plain text). Do not just change the file extension and hope for the best – the chances are that we won't be able to read it.

That is one really good aspect of email. If you send us an article inserted as a text file, you will be able to read it on the screen, before you click on the "send" button.

Still on word processors: if you have Microsoft Word it is a good idea to make full use of its grammar and spell-checking capabilities. Make sure you have the English dictionary loaded, not the American. Also, it is a good idea to use Word's readability statistics after you have run a spell check.

If you want to make your article as readable as possible, keep the sentences and paragraphs reasonably short. Try to make sentences active, not passive and not too wordy. If the Word "Flesch-Reading Ease" score is below 40 (out of 100), you know you have a problem.

Photographs and graphics

As you can see from most of the articles in SILICON CHIP, we generally like to include plenty of photos and diagrams. So what to do?

While some people do go to the trouble of taking photos of their projects, they are rarely good enough for publication. We much prefer to take our own photos and for that reason (and also to check the operation of your project) we generally prefer to have the prototype submitted to us.

We do return prototypes, whether or not the article is published.

We know there are times when it may be

By LEO SIMPSON

impractical or impossible to send us your project and therefore you wish to take your own photos.

We work in 35mm format only and prefer colour transparencies (ie, so-called colour slides). The sharper they are, the better. It does not matter to us if the slide is mounted or unmounted (but unmounted cost you less to have processed); if unmounted, please do **not** cut slides into individual frames. Most "neg files" hold a strip of 6 negatives or transparencies – that's fine for us.

By the way, send us all the frames you shoot – we like to choose the best exposures, best focus and best framing, ourselves.

We don't want 2-1/4-inch square or larger format transparencies, as we then have to out-source the scanning which can delay publication.

If you only have colour prints, send us the colour negatives as well. We scan the latter as they have far more detail, contrast and colour than any colour print.

If you want to take your own photos, you really need a single-lens reflex 35mm camera with separate control over aperture, exposure time and focus. And while modern, automatic cameras might be great for happy-snaps of your family on holidays, they are really not suitable for magazine photography because you have no control over aperture and depth of field.

If you are taking photos of your project, vintage radio or whatever, don't do it on your front lawn, grubby garage floor or against a brick wall. Try to use a neutral background which contrasts with the object you are photographing. You can use a plain or light pastel bedsheet, but make sure it is spotless and has been carefully ironed to take out the creases – remember that the camera will ruthlessly record any blemishes. Remember also that any shiny surfaces on the object being photographed will pick up the background (foreground) colour and can give unwanted colour casts.

Speaking of unwanted colour casts, taking photos under fluorescent light will give a greenish cast while incandescent lighting will give a red cast. Direct sunlight will give very strong shadows which can conceal detail while indirect sunlight can give an overall blue cast. Can't win, can you?

Well, you can, but it is best to be aware of all the traps. The best light – by far – is outdoors with a lightly overcast sky. Shadows will be minimised or even eliminated and the light is virtually pure white. But sometimes you don't get those overcast days without the rain pouring down!

That is why it is preferable to send us the project and we'll take the photos in our studio. If we mess up, we have to do it again!

Digital photos

Digital cameras have come a long way in recent times but the majority are still not good enough for magazine photography.

Some high-end digital cameras which have a resolution of at least 3 megapixels (4 is better) and which also allow you to control aperture, exposure and focus can produce good results (the cover photo on the August 2001 issue of SILICON CHIP was shot "natural light" with a 3.3 megapixel digital camera outdoors on a cloudy day).

Photographs shot on a digital camera need to be done at the camera's highest possible resolution. Many digital cameras store photos at 72dpi. This is OK if the image size is very large but not if it is small. We can manipulate the photo to some degree but only if we have plenty of pixels to start with!

As a general rule, if a digital picture will fit on a floppy disk, it will probably NOT be good enough for reproducing in the magazine. There are exceptions, especially where photos are going to be printed very small, but we find that an average compressed photo needs to be at least 2MB to be of much use, particularly where we are going to use it at a reasonable size.

If sending pictures by email or on a ZIP disk or CD, you can store them in any recognised format: .EPS, .BMP, .TIF, JPG, .ZIP, etc – but remember that JPG is a lossy format and .JPG files should not be resampled and restored. ZIPped EPS or TIF are our preferred formats.

Scanned photos

We would very much prefer to scan any photos (or other artwork) ourselves. Scanning is an art, especially when it comes to scanning for reproduction in a magazine.

Circuit diagrams

We need a clear and legible circuit diagram. This can be a pencil sketch or a computer printout but whatever format you provide, we will **always** redraw it to our standards.

If possible, when you draw your circuit diagram stick to the conventions of inputs on the left, outputs on the right, positive supply rails at the top and negative/ground rails at the bottom.

You will have noted that we do not use "nF" in our circuit diagrams or descriptions – please convert to µF or pF.

Those who are constantly working in electronics understand nF, those who dabble part time are confused by the extra abbreviation.

For the same reason, we do not use so-called "metricated" abbreviations for resistors – eg, 1K5 meaning 1.5k or R33 for 33 ohms.

Printed circuit boards

If you have produced a PC board we prefer that the pattern be drawn in Protel or any version of PC board layout software compatible with Protel: Easytrax, Autotrax, or Circuit Maker.

If you design your PC board in another package (eg Eagle, Ivex, etc), we will need an EPS output of each layer – board layer and component layer for a single-sided board.

Designing PC boards is a separate topic in itself and we hope to feature an article on this subject shortly. However, as a general rule, keep components more or less evenly spaced on a 50-thou grid (typical) and parallel to the sides of the board; don't have diagonal components – it doesn't look right.

Other points to consider:

(a) circuit components must be readily available and reasonable in cost.

(b) 240VAC wiring must be safe and comply with all relevant codes. **SC**

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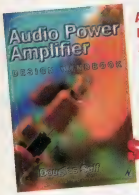

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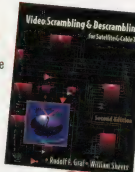

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This book is for anyone involved in designing, adapting and using analog and digital audio equipment. It covers tape recording, tuners and radio receivers, preamplifiers, voltage amplifiers, audio power amplifiers, compact disc technology and digital audio, test and measurement, loudspeaker crossover systems, power supplies and noise reduction systems. 375 pages in soft cover.

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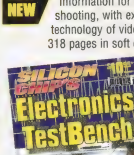

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INTERNET NEWSGROUP

Browsing web pages or search engines is one way to get information off the 'net. But asking a question on an appropriate Newsgroup is often much better. Here are some of the terms you'll find used – and over the page, many of those mysterious abbreviations!

add (also join and subscribe)

The act of adding a newsgroup to your personal list of newsgroups. These are the groups that you see when you start up your newsreader. See also: remove.

article (also post)

An individual message in a newsgroup. When a person sends or posts an article and other people reply to it, it forms a thread.

binary

A type of newsgroup article that contains encoded binary information, such as a picture, sound, or software application. There are special groups for binary files, such as alt.binaries.clip-art.

cancel, cancelbot

The act of retracting or removing one's newsgroup article. Cancelbots are programs that cancel spam posts.

charter

An official description of what a newsgroup is all about, whether it's moderated, and what kinds of topics the group will discuss. For specific information about a newsgroup, read the group's FAQ.

cross-post

To copy an article to multiple newsgroups. Cross-posting should be done sparingly, and only when the post is relevant to the affected newsgroups. Excessive cross-posting is a lot like spam, and is nicknamed "velveeta."

delurk

To post an article to a newsgroup for the first time. (Just like when a radio-show caller says "Long-time listener, first-time caller.") See lurk.

Emoticon (also smiley)

Little faces made out of keyboard characters, used to express smiles :-) winks ;-) surprise :-0 and more. (If you don't understand the emoticon, put your left ear on your left shoulder and look again!)

expired article

Newsgroup articles are stored for a limited time, after which they are deleted to make room for new ones. An article that has been deleted and no longer available has "expired." (This is why the number of articles listed doesn't always match the number of articles that show up – the other articles have expired.)

FAQ

(Frequently Asked Questions) A list of answers to Frequently Asked Questions and other useful information for a newsgroup. (When pronouncing, spell it out or rhyme "FAQ" with "back.") Always read a newsgroup's FAQ before you post.

FileGrabber

Utility for automatic downloading and processing of binary files, such as images, sounds, or shareware.

flame

An angry newsgroup article or e-mail that viciously attacks someone or something. Usually written in the heat of the moment. Often starts a flamewar. Also, the act of sending or posting a flame. A person who flames is a "flamer."

flame bait

Provocative material in an article that, intentionally or unintentionally, will make people angry and invite flames in response. See trolling.

flame war

A argument or fight that takes place in newsgroup articles or e-mail. Flamewars involve lots of name-calling, nasty insults, and "YELLING."

follow up (also reply)

To respond to an article by posting a response to the newsgroup. See quoting.

header

Part of a newsgroup article or e-mail message that contains information needed by the computers that handled it. Hard-to-read but informative,the message ID, date, and time.

hierarchy

The categories of newsgroups. The main categories are: **comp.** (computer topics), **misc.** (miscellaneous), **news.** (newsgroup-related stuff), **rec.** (recreation), **sci.** (science), **soc.** (society), **talk.** (discussion), and **alt.** (alternative). Hierarchies are arranged so they get more specific as you work your way down. For example:
rec.* (recreation groups — the "*" means "include everything under this")
rec.collecting. (recreation groups about collecting)
rec.collecting.sport.* recreation groups about sports collecting)
rec.collecting.sport.football (a recreation group about sports collecting, specifically football)
Note that rec.collecting.sport.* would also include sports collecting groups about baseball, hockey, etc.
There are also special, regional, and local hierarchies that may not be available to all people.

kill file

A file used by some newsreaders to reject unwanted articles. A kill file will reject posts containing words, authors, or subjects that you don't want to see. Also known as a "bozo filter." (Some newsgroup users signify adding an article or thread to their killfile by replying with the word "*plonk*.")

list unread

A newsreader command that allows you to see only the messages that you haven't read before in a given newsgroup.

list all

A newsreader command that shows you all the messages in a newsgroup, including messages you have already read (as long as they haven't expired).

lurk

To read articles in a newsgroup without posting any of your own. Always lurk a while before posting, to get a feel for the newsgroup. A person who lurks is a "lurker." See delurk.

mark read (also catch up)

A newsreader command that marks all the articles in a newsgroup as having been read. Do this after you've read the interesting posts in a newsgroup and only want to see new posts the next time you visit.

MMF

An abbreviation for MAKE MONEY FAST; also the generic name for any of the useless, futile, and often illegal pyramid schemes that promise to "make $5 into $50,000" or "GET RICH QUICK" by spamming newsgroups.

COMMON TERMS

(Sorry – we didn't mean to yell!)

There's a Newsgroup for every conceivable subject – and then some! If you have Internet access, you almost certainly have Newsgroup access. Ask your ISP if you don't know how to subscribe.

They don't work, they're annoying and people will flame you, so don't ever do it. Posting MMF-type posts is very bad netiquette.

moderated newsgroup

A newsgroup where all posts must be approved before they can be seen by all. The people who do the filtering are known as moderators. Moderated newsgroups typically have a lot of information, and very little spam or garbage. See signal-to-noise ratio.

Netiquette

Network etiquette. Since there are no Internet Police, a set of rules and guidelines on acceptable behavior has developed organically. Netiquette includes things like not spamming, learning to lurk before posting, and more. Learn netiquette and you won't get flamed.

newbie

A beginner. All experts were newbies once.

news

Another name for newsgroups. Also "Netnews," "USENET," or "Usenet."

newsgroup (also group)

An Internet discussion forum, such as rec.pets.cats or alt.internet.services. All together, the thousands of newsgroups form a global bulletin board where people talk about every topic imaginable. Newsgroups are where you post articles.

newsreader

The software you use to access newsgroups. A newsreader lets you read articles, respond to them, and post your own.

periodic posting

A newsgroup article that is posted to a group or groups at regular intervals. An example of a periodic posting would be a FAQ (list of Frequently Asked Questions) or other helpful information.

post

A newsgroup article. Also, the act of sending an article to a newsgroup so that others can read and reply to it.

quote

To include part of a previous post when you follow up to it. Quoting is a good idea because it lets people know what you're talking about. Quoted material often is preceded by ">" and looks like:

> This is an example of quoted material. Here is some more
> quoted material, to let people know what you are replying to.

This would be where your new comments would begin.

remove

The newsgroup command to unsubscribe from a newsgroup.

reply

A newsgroup article that is posted to the newsgroup as a response to another post. It's usually a good idea to quote from the article you're replying to so people know what you're talking about. When replying, avoid posting simply "me too" or "I agree."

Request for Discussion (RFD)

An official posting to news.groups that asks for comments and opinions regarding the proposal to create a new newsgroup. Part of the formal newsgroup creation process.

signal-to-noise ratio

An electronics term used to compare the amount of good, useful info ("signal") in a newsgroup with the amount of bad, useless junk ("noise"). Newsgroups that have lots of flame wars and spam have a low signal-to-noise ratio.

signature (also sig)

Text added to the bottom of an article or e-mail to give the reader more information about the poster. Signatures can include e-mail and Web addresses, quotes, text art, and more, though signatures should not be longer than 4 or 5 lines.

spam

An article that is sent to hundreds or thousands of different newsgroups, and has nothing to do with any of them. Often advertisements or "MAKE MONEY FAST"-type chain letters. Very annoying and a very bad violation of netiquette. The act of sending spam is "spamming." Someone who sends spam is a "spammer." The term "spam" comes from the Monty Python sketch where the name of the canned meat product is used so often that it crowds everything else out.

spoiler

Information that may diminish the enjoyment someone else gets from a book, movie, tv show, etc. Example: Posting "The Titanic sinks!!!" in a current movies newsgroup may spoil someone who hasn't seen Titanic. Be nice: Use warnings (like adding "SPOILER: Titanic" to the subject line) and add **spoiler space** (blank lines before spoiler information) to posts that may contain spoilers.

subscribe

To add a newsgroup to the list of groups you want to read. If you subscribe to a group, that newsgroup will appear every time you open your newsreader. In the vast majority of cases, subscribing is free. See unsubscribe.

test

A test message, usually posted by newbies. Test messages should only be sent to newsgroups specifically designed for this purpose, such as misc.test. Warning: put "Ignore" in your test message's subject or body, unless you want lots of automatically generated response mail.

thread

A thread is an ongoing discussion of related messages that grows from one particular posting.

troll

A purposely stupid, inflammatory, or downright wrong article (closely related to flamebait). Its purpose is to get people mad and make them look stupid and gullible

unsubscribe

To remove a newsgroup from your newsreader's active list. If you unsubscribe, you will no longer see the newsgroup when you open your newsreader. You can always subscribe again.

Usenet (also USENET)

The full name of newsgroups is "Usenet Newsgroups."

YELLING

To yell on a newsgroup, use capitals. Unless you are deliberately yelling, using capitals is considered to be pretty bad Netiquette!

Newsgroup Abbreviations

COMMON ABBREVIATIONS

AFAIK - "As Far As I Know"
AKA - "Also Known As"
ASAP - "As Soon As Possible"
BTW - "By The Way"
BRB - "Be Right Back"
FAQ - "Frequently asked questions"
FYI - "For Your Information"
FWIW - "For What It's Worth"
FIIK - "... If I Know"
FUBAR - "... Up Beyond All Recognition"
GD&R - "Grinning, Ducking and Running (After snide remark)
IAEF - "If All Else Fails"
IANAL - "I Am Not A Lawyer (But...)"
IDK - "I don't know"
IMHO - "In My Humble Opinion"
IMO - "In My Opinion"
IYKWIM - "If You Know What I Mean"
IYKWIMAITYD - "If You Know What I Mean And I Think You Do"
LOL - "Laughing Out Loud"
OK - abbreviation of "oll korrect", alteration of "all correct"
OTOH - On The Other Hand
PITA - "Pain In The Ass"
PMFJI - "Pardon Me For Jumping In"
PS - "Post Script"
TIA - "Thanks In Advance"
TPTB - "The Powers That Be"
TTFN - "Ta Ta For Now"
ROTFL - "Rolling On The Floor Laughing"
RTFM - "Read The . . . Manual
SOHF - "Sense Of Humor Failure"
SWALK - "Sealed With A Loving Kiss"
WRT - "With Respect To"
WYSIWYG - "What You See Is What You Get"
YMMV - "Your Mileage May Vary" (You may not have the same luck I did)
YWIA - "You're Welcome In Advance"
AFK = away from keyboard
BAK = back at keyboard
BRB = be right back
WB = welcome back
GMTA = great minds think alike
WTG = way to go
RSI = repetitive strain injury

COMMON (and many uncommon!) EMOTICONS :-)

:-) Happy
(:- Left Handed/Australian
:-(Sad
;-) Winky
#-) Oh, what a night!
=: O Yelling/Shocked
:- | Frowning
~~:-[Net Flame
:-$ Put Your Money Where Your Mouth Is
:-P Sticking Out Tongue
:-@ Screaming/Swearing/Very Angry/ About To Be Sick
:*) Drunk/Clown
:-# Been Smacked In The Mouth/ Wears A Brace/Kiss R Broken Glasses
-) Bald
(:-) Bald
:-))) Is Very Fat
:-{} Wears Lipstick
=:-) A Dickhead
@:-) Wears A Turban
$-) Yuppie/Just Won A Large Sum Of Money
:,(Crying :
=) Two Noses
8:] Gorilla
8-) Wears Glasses
B:-) Wears Sun Glasses On Head
:-T Keeping A Straight Face/Tight Lipped
:-y Said With A Smile
:-| Disgusted/Grim/No Expression
:~-(Crying/Shed A Tear
:'-(Crying
:~(~~ Crying
:-Q A Smoker
:-! A Smoker
%-\ Has A Hangover
|-o Bored
:-X A Kiss/Lips Are Sealed
(:-D Has A Big Mouth
(:+) Has A Big Nose
:-(} Has A Moustache
:-* Just Ate Something Sour/Bitter Taste/Kiss
[:-) Is Wearing A Walkman
(:-) Bicycle Helmets
:-)' Tends To Drool
=:-) Punk
+~:-) The Pope
O:-) An Angel
*<:-)> Santa
o~<:-{{{ Santa
*<|:-) Santa/A Clown
5:-) Elvis Presley
:-% Banker
:-: Mutant Smiley
(-:|:-) Siamese Twins
7:-) Fred Flinstone
:/7) Cyrano de Bergerac
C):-O C):-O C):-O C):-O A Barbershop Quartet
3:-o A Cow
8:-) A Pig/A Little Girl
:V A Woodpecker
]:-> The Devil
,-) A One Eyed Winky
|-(Lost Contact Lenses
#:-) Matted Hair/Fur Hat/Crewcut/ Messy Hair
&:-) Curly Hair
C=:-) A Chef
@}->— A Rose
=|:-)= Uncle Sam/Abe Lincoln
7:) Ronald Reagan
+<:-| Monk/Nun
:_) A Boxer/Had a Fight
{ A Psycho
(:I An Egghead
b:-) A Baseball Fan/Has A Cap On
(-) Needs A Haircut
:-(*) Feels Sick
*****:-) Marge Simpson
[:] A Robot
:-[A Vampire/Count Dracula/Pouting/ Sarcastic
:-F A Bucktoothed Vampire/Has Major Dental Problems
:=) Orangutan/Has Two Noses
:-? Smokes A Pipe
:-8(Condescending
8-# Death/Dead
:^) Smirking
:——} Liar/Pinnochio
!-(Black Eye
) Cheshire Cat
(:-D Blabber Mouth
> A Schizo
#!^*&:-) phrenic
:-'| Has A Cold/Flu
:$) Donald Trump
:-.) Marilyn Monroe/Madonna
:-) 8 Dolly Parton
:-|:-| Deja'vu
<*:oDX A Clown
C|:-= Charlie Chaplin
: .) Cindy Crawford
=) Adolf Hitler
~:o A Baby
===:-D Don King
8(:-) Mickey Mouse/Walt Disney
(|-| F Robocop
3:*> Rudolph the Reindeer
P-) A Pirate
%~~ Picasso
':-) Has One Eyebrow

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February 1994: Build A 90-Second Message Recorder; 12-240VAC 200W Inverter; 0.5W Audio Amplifier; 3A 40V Adjustable Power Supply; Engine Management, Pt.5; Airbags In Cars – How They Work.

March 1994: Intelligent IR Remote Controller: 50W (LM3876) Audio Amplifier Module; Level Crossing Detector For Model Railways; Voice Activated Switch For FM Microphones; Engine Management, Pt.6.

April 1994: Sound & Lights For Model Railway Level Crossings; Discrete Dual Supply Voltage Regulator; Universal Stereo Preamplifier; Digital Water Tank Gauge; Engine Management, Pt.7.

May 1994: Fast Charger For Nicad Batteries; Induction Balance Metal Locator; Multi-Channel Infrared Remote Control; Dual Electronic Dice; Simple Servo Driver Circuits; Engine Management, Pt.8.

June 1994: 200W/350W Mosfet Amplifier Module; A Coolant Level Alarm For Your Car; 80-Metre AM/CW Transmitter For Amateurs; Converting Phono Inputs To Line Inputs; PC-Based Nicad Battery Monitor; Engine Management, Pt.9.

July 1994: Build A 4-Bay Bow-Tie UHF TV Antenna; PreChamp 2-Transistor Preamplifier; Steam Train Whistle & Diesel Horn Simulator; 6V SLA Battery Charger; Electronic Engine Management, Pt.10.

August 1994: High-Power Dimmer For Incandescent Lights; Microprocessor-Controlled Morse Keyer; Dual Diversity Tuner For FM Microphones; Pt.1: Nicad Zapper (For Resurrecting Nicad Batteries); Electronic Engine Management, Pt.11.

September 1994: Automatic Discharger For Nicad Battery Packs; MiniVox Voice Operated Relay; Image Intensified Night Viewer; AM Radio For Weather Beacons; Dual Diversity Tuner For FM Microphones, Pt.2: Electronic Engine Management, Pt.12.

October 1994: How Dolby Surround Sound Works; Dual Rail Variable Power Supply; Build A Talking Headlight Reminder; Electronic Ballast For Fluorescent Lights; Electronic Engine Management, Pt.13.

November 1994: Dry Cell Battery Rejuvenator; Novel Alphanumeric Clock; 80-Metre DSB Amateur Transmitter; Twin-Cell Nicad Discharger (See May 1993); How To Plot Patterns Direct to PC Boards.

December 1994: Easy-To-Build Car Burglar Alarm; Three-Spot Low Distortion Sinewave Oscillator; CIRCy — A Pesky Electronic Cricket; Remote Control System for Models, Pt.1; Index to Vol.7.

January 1995: Sun Tracker For Solar Panels; Battery Saver For Torches; Dolby Pro-Logic Surround Sound Decoder, Pt.2; Dual Channel UHF Remote Control; Stereo Microphone Preamplifier.

February 1995: 50-Watt/Channel Stereo Amplifier Module; Digital Effects Unit For Musicians; 6-Channel Thermometer With LCD Readout; Wide Range Electrostatic Loudspeakers, Pt.1; Oil Change Timer For Cars; Remote Control System For Models, Pt.2.

March 1995: 50 Watt Per Channel Stereo Amplifier, Pt.1; Subcarrier Decoder For FM Receivers; Wide Range Electrostatic Loudspeakers, Pt.2; IR Illuminator For CCD Cameras; Remote Control System For Models, Pt.3; Simple CW Filter.

April 1995: FM Radio Trainer, Pt.1; Photographic Timer For Darkrooms; Balanced Microphone Preamp. & Line Filter; 50W/Channel Stereo Amplifier, Pt.2; Wide Range Electrostatic Loudspeakers, Pt.3; 8-Channel Decoder For Radio Remote Control.

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May 1995: Build A Guitar Headphone Amplifier; FM Radio Trainer, Pt.2; Transistor/Mosfet Tester For DMMs; A 16-Channel Decoder For Radio Remote Control; Introduction To Satellite TV.

June 1995: Build A Satellite TV Receiver; Train Detector For Model Railways; 1W Audio Amplifier Trainer; Low-Cost Video Security System; Multi-Channel Radio Control Transmitter For Models, Pt.1.

July 1995: Electric Fence Controller; How To Run Two Trains On A Single Track (Incl. Lights & Sound); Setting Up A Satellite TV Ground Station; Build A Reliable Door Minder.

August 1995: Fuel Injector Monitor For Cars; Gain Controlled Microphone Preamp; Audio Lab PC-Controlled Test Instrument, Pt.1; How To Identify IDE Hard Disk Drive Parameters.

September 1995: Railpower Mk.2 Walkaround Throttle For Model Railways, Pt.1; Keypad Combination Lock; The Vader Voice; Jacob's Ladder Display; Audio Lab PC-Controlled Test Instrument, Pt.2.

October 1995: 3-Way Bass Reflex Loudspeaker System; Railpower Mk.2 Walkaround Throttle For Model Railways, Pt.2; Fast Charger For Nicad Batteries; Digital Speedometer & Fuel Gauge For Cars, Pt.1.

November 1995: Mixture Display For Fuel Injected Cars; CB Transverter For The 80M Amateur Band, Pt.1; RPM Movement Detector; Digital Speedometer & Fuel Gauge For Cars, Pt.2.

December 1995: Engine Immobiliser; 5-Band Equaliser; CB Transverter For The 80M Amateur Band, Pt.2; Subwoofer Controller; Knock Sensing In Cars; Index To Volume 8.

January 1996: Surround Sound Mixer & Decoder, Pt.1; Magnetic Card Reader; Build An Automatic Sprinkler Controller; IR Remote Control For The Railpower Mk.2; Recharging Nicad Batteries For Long Life.

April 1996: Cheap Battery Refills For Mobile Phones; 125W Audio Amplifier Module; Knock Indicator For Leaded Petrol Engines; Multi-Channel Radio Control Transmitter; Pt.3.

May 1996: Upgrading The CPU In Your PC; High Voltage Insulation Tester; Knightrider Bi-Directional LED Chaser; Simple Duplex Intercom Using Pore Grid Diodes; Audio Loudspeakers, Pt.3.

June 1996: BassBox CAD Loudspeaker Software Reviewed; Stereo Simulator (uses delay chip); Rope Light Chaser; Low Ohms Tester For Your DMM; Automatic 10A Battery Charger.

July 1996: Build A VGA Digital Oscilloscope, Pt.1; Remote Control Extender For VCRs; CLA Battery Charger; 3-Band Parametric Equaliser; Single Channel 8-Bit Data Logger.

August 1996: Introduction to IGBTs; Electronic Starter For Fluorescent Lamps; VGA Oscilloscope, Pt.2; 350W Mosfet Power Module; Masthead Amplifier For TV & Satellite; Dog Deterrent.

September 1996: VGA Oscilloscope, Pt.3; IR Stereo Headphone Link, Pt.1; High Quality PA Loudspeaker; 3-Band HF Amateur Radio Receiver; Cathode Ray Oscilloscopes, Pt.1.

October 1996: Sand Video Signals Over Twisted Pair Cable; Power Control With A Light Dimmer; 600W DC-DC Converter For Car Hifi Systems, Pt.1; IR Stereo Headphone Link, Pt.2; Build A Multi-Media Sound System, Pt.1; Multi-Channel Radio Control Transmitter, Pt.6.

November 1996: 8-Channel Stereo Mixer, Pt.1; Low-Cost Fluorescent Light Inverter; Repairing Domestic Light Dimmers; Multi-Media Sound System, Pt.2; 600W DC-DC Converter For Car Hifi Systems, Pt.2.

December 1996: Active Filter Cleans Up Your CW Reception; A Fast Clock For Railway Modellers; Laser Pistol & Electronic Target; Build A Sound Level Meter; 8-Channel Stereo Mixer, Pt.2; Index To Volume 9.

January 1997: How To Network Your PC; Control Panel For Multiple Smoke Alarms, Pt.1; Build A Pink Noise Source; Computer Controlled Dual Power Supply, Pt.1; Temp Monitor With Two Temperatures.

February 1997: PC-Controlled Moving Message Display; Computer Controlled Dual Power Supply, Pt.2; Alert-A-Phone Loud Sounding Telephone Alarm; Control Panel For Multiple Smoke Alarms, Pt.2.

March 1997: Driving A Computer By Remote Control; Plastic Power PA Amplifier (175W); Signalling & Lighting For Model Railways; Build A Jumbo LED Clock; Cathode Ray Oscilloscopes, Pt.7.

April 1997: Simple Timer With No ICs; Digital Voltmeter For Cars; Loudspeaker Protector For Stereo Amplifiers; Model Train Controller; A Look At Signal Tracing; Pt.1; Cathode Ray Oscilloscopes, Pt.8.

May 1997: Neon Tube Modulator For Light Systems; Traffic Lights For A Model Intersection; The Spacemotor – It Writes Messages In Thin Air; A Look At Signal Tracing, Pt.2; Cathode Ray Oscilloscopes, Pt.9.

June 1997: PC-Controlled Thermometer/Thermostat; TV Pattern Generator, Pt.1; Audio/RF Signal Tracer; High-Current Speed Controller For 12V/24V Motors; Manual Control Circuit For Stepper Motors.

July 1997: Infrared Remote Volume Control; A Flexible Interface Card For PCs; Power Controller For Model Railways; Colour TV Pattern Generator, Pt.2; An In-Line Mixer For Radio Control Receivers.

August 1997: The Bass Barrel Subwoofer; 500 Watt Audio Power Amplifier Module; A TENs Unit For Pain Relief; Addressable PC Card For Stepper Motor Control; Remote Controlled Gates For Your Home.

September 1997: Multi-Spark Capacitor Discharge Ignition; 500W Audio Power Amplifier, Pt.2; A Video Security System For Your Home; PC Card For Controlling Two Stepper Motors; HiFi On A Budget.

October 1997: Build A 5-Digit Tachometer; Add Central Locking To Your Car; PC-Controlled 6-Channel Voltmeter; 500W Audio Power Amplifier, Pt.3; Customising The Windows 95 Start Menu.

November 1997: Heavy Duty 10A 240VAC Motor Speed Controller; Easy-To-Use Cable & Wiring Tester; Build A Musical Doorbell; Replacing Foam Speaker Surrounds; Understanding Electric Lighting Pt.1.

December 1997: A Speed Alarm For Your Car; Two-Axis Robot With Gripper; Loudness Control For Car Hifi Systems; Stepper Motor Driver With Onboard Buffer Memory; Power Supply For Stepper Motor Cards; Understanding Electric Lighting Pt.2; Index To Volume 10.

January 1998: Build Your Own 4-Channel Lightshow, Pt.1 (runs off 12VDC or 12VAC); Command Control System For Model Railways, Pt.1; Pic Controlled Servo Driver; Build A One Or Two-Lamp Flasher; Understanding Electric Lighting, Pt.3.

February 1998: Multi-Purpose Fast Battery Charger, Pt.1; Telephone Exchange Simulator For Testing; Command Control System For Model Railways, Pt.2; Build Your Own 4-Channel Lightshow, Pt.2; Understanding Electric Lighting, Pt.4.

April 1998: Automatic Garage Door Opener, Pt.1; 40V 8A Adjustable Power Supply, Pt.1; Build A Programmable 0-300Hz Sinewave Generator; Build A Laser Light Show; Understanding Electric Lighting, Pt.6.

May 1998: Troubleshooting Your PC, Pt.1; Build A 3-LED Logic Probe; Automatic Garage Door Opener, Pt.2; Command Control For Model Railways, Pt.4; 40V 8A Adjustable Power Supply, Pt.2.

June 1998: Troubleshooting Your PC, Pt.2; Understanding Electric Lighting, Pt.7; Universal High Energy Ignition System; The Roadies' Friend Cable Tester; Universal Stepper Motor Controller; Command Control For Model Railways, Pt.5.

July 1998: Troubleshooting Your PC, Pt.3 (Installing A Modem And Solving Problems); Build A Heat Controller; 15-Watt Class-A Audio Amplifier Module; Simple Battery Monitor For 12V Batteries; Automatic Semiconductor Analyser; Understanding Electric Lighting, Pt.8.

August 1998: Troubleshooting Your PC, Pt.4 (Adding Extra Memory); Build The Opus One Loudspeaker System; Simple I/O Card With Automatic Data Logging Facility; A Beat Triggered Strobe; A 15-Watt Per Channel Class-A Stereo Amplifier.

September 1998: Troubleshooting Your PC, Pt.5 (Software Problems & DOS Games); A Blocked Air-Filter Alarm; A Waa-Waa Pedal For Your Guitar; Build A Plasma Display Tube; Battery Saver Gear Change Indicator For Cars; Capacity Indicator For Rechargeable Batteries.

October 1998: Lab Quality AC Millivoltmeter, Pt.1; PC-Controlled Stress-O-Meter; Versatile Electronic Guitar Limiter; 12V Trickle Charger For Float Controlled Batteries; Adding An Internal Battery Pack To Your Flashgun.

November 1998: The Christmas Star; A Turbo Timer For Cars; Build A Poker Machine, Pt.1; FM Transmitter For Musicians; Lab Quality AC Millivoltmeter, Pt.2; Simple Battery Monitor For 6V Batteries; Understanding Electric Lighting, Pt.9; Improving AM Radio Reception, Pt.1.

December 1998: Protect Your Car With The Engine Immobiliser Mk.2; Thermocouple Adaptor For DMMs; A Regulated 12V DC Plugpack; Build Your Own Pocket Radar; Pic-Programmable Car Computer; AM Radio Reception, Pt.2; Mixer Module For F3B Glider Operations.

January 1999: High-Voltage Megohm Tester; Getting Started With BASIC Stamp; LED Bargraph Ammeter For Cars; Keypad Engine Immobiliser; Improving AM Radio Reception, Pt.3; Electric Lighting, Pt.10.

February 1999: Installing A Computer Network; Making Front Panels For Your Projects; Low-Distortion Sinewave Oscillator, Pt.1; Command Control Decoder For Model Railways; Build A Digital Capacitance Meter; Build A Remote Control Tester; Electric Lighting, Pt.11.

March 1999: Getting Started With Linux; Pt.1; Build A Digital Anemometer; 5-Channel Current Monitor With Data Logging; Simple DIY PIC Programmer; Easy-To-Build Audio Compressor; Low Distortion Audio Signal Generator, Pt.2; Electric Lighting, Pt.12.

April 1999: Getting Started With Linux; Pt.2; High-Power Electric Fence Controller; Build A Remote Control Model; Thermostat/ Thermometer; Build An Infrared Sentry; Rev Limiter For Cars; Electric Lighting, Pt.13; Audiophile Radio Controlled Model Aircraft.

May 1999: The Line Dancer Robot; An X-Y Table With Stepper Motor Control, Pt.1; Three Electric Fence Testers; Heart Of LEDs; Build A Carbon Monoxide Alarm; Getting Started With Linux; Pt.3.

June 1999: FM Radio Tuner Card For PCs; X-Y Table With Stepper Motor Control, Pt.2; Programmable Ignition Timing Module For Cars, Pt.1; Hard Disk Drive Upgrades Without Reinstalling Software?

July 1999: Build A Dog Silencer; 10µH to 19.99mH Inductance Meter; Build An Audio-Video Transmitter; Programmable Ignition Timing Module For Cars, Pt.2; X-Y Table With Stepper Motor Control, Pt.3.

August 1999: Remote Modem Controller; Daytime Running Lights For Cars; Build A PC Monitor Checker; Switching Temperature Controller; XYZ Table With Stepper Motor Control, Pt.4; Electric Lighting, Pt.14.

September 1999: Automatic Addressing On TCP/IP Networks; Autonomous The Robot, Pt.1; Voice Recognition Recognition Module; Digital Electrolytic Capacitance Meter; XYZ Table With Stepper Motor Control, Pt.5; Pattern Powered Can Cooler.

October 1999: Build The Railpower Model Train Controller, Pt.1; Semiconductor Curve Tracer; Autonomouse The Robot, Pt.2; XYZ Table With Stepper Motor Control, Pt.6; Introducing Home Theatre.

November 1999: Electric Lighting, Pt.15; Setting Up An Email Server; Speed Alarm For Cars, Pt.1; Multi-Colour LED Christmas Tree; Build An Intercom Station Expander; Foldback Loudspeaker System For Musicians; Railpower Model Train Controller, Pt.2.

December 1999: Electric Lighting, Pt.16; Build A Solar Panel Regulator; The PC Powerhouse (gives fixed +12V, +9V, +6V & +5V rails); The Fortune Finder Metal Locator; Speed Alarm For Cars, Pt.2; Railpower Model Train Controller, Pt.3; Index To Volume 12.

January 2000: Spring Reverberation Module; An Audio-Video Test Generator; Build The Picman Programmable Robot; A Parallel Port Interface Card; Off-Hook Indicator For Telephone Lines.

February 2000: Multi-Sector Sprinkler Controller; A Digital Voltmeter For Your Car; An Ultrasonic Parking Radar; Build A Safety Switch Checker; Build A Sine/Square Wave Oscillator; Murantz SR-16 Home Theatre Receiver; The "Hot Chip" Starter's Project.

March 2000: Doing A Lazarus On An Old Computer; Ultra Low Distortion 100W Amplifier Module, Pt.1; Electronic Wind Vane With 16-LED Display; Glowdoug Driver For Powered Models; The DzTrip Car Computer, Pt.1; Multisim Circuit Design & Simulation Package (Review).

April 2000: A Digital Tachometer For Your Car; RoomGuard – A Low-Cost Intruder Alarm; Build A Hot wire Cutter; The DzTrip Car Computer, Pt.2; Build A Noncontacting Logger; Altmel's 32K 200 Hi-Circuit Emulator; How To Run A 3-Phase Induction Motor From 240VAC.

May 2000: Ultra-LD Stereo Amplifier, Pt.2; Build A LED Dice (With PIC Microcontroller); Low-Cost AT Keyboard Translator (Converts IBM Scan-Codes To ASCII); 10A Motor Speed Controller For Models.

June 2000: Automatic Rain Gauge With Digital Readout; Parallel Port VHF FM Receiver; LI Powerhouse Switchmode Power Supply (1.23V to 40V) Pt.1; CD Compressor For Cars Or The Home.

July 2000: A Moving Message Display; Compact Fluorescent Lamp Driver; El-Cheapo Modules; Lead Tester; LI Powerhouse Switchmode Power Supply (1.23V to 40V) Pt.2; Say Bye-Bye To Your 12V Car Battery.

August 2000: Build A Theremin For Really Eerie Sounds; Come In Spinner (writes messages in "thin-air"); Loudspeaker Protector & Fan Controller For The Ultra-LD Stereo Amplifier; Proximity Switch For 240VAC Lamps; Structured Cabling For Computer Networks.

September 2000: Build A Swimming Pool Alarm; An 8-Channel PC Relay Board; Fuel Mixture Display For Cars, Pt.1; Protoboards – The Easy Way Into Electronics, Pt.1; Cybug The Solar Fly.

October 2000: Guitar Jammer For Practice & Jam Sessions; Booze Buster Breath Tester; A Video-Mounted Inspection Camera; Installing A Free-Air Subwoofer In Your Car; Fuel Mixture Display For Cars, Pt.2; Protoboards – The Easy Way Into Electronics, Pt.2.

November 2000: Santa & Rudolf Christie Display; 2-Channel Guitar Preamplifier, Pt.1; Message Bank & Missed Call Alert; Electronic Thermostat; Protoboards – The Easy Way Into Electronics, Pt.3.

December 2000: Home Networking For Shared Internet Access; Build A Bright-White LED Torch; 2-Channel Guitar Preamplifier, Pt.2 (Digital Reverb); Driving An LCD From The Parallel Port; Build A Morse Clock; Protoboards – The Easy Way Into Electronics, Pt.4; Index To Vol.13.

January 2001: LP Resurrection – Transferring LPs & Tapes To CD; The LP Doctor – Close Up Clicks & Pops, Pt.1; Kenwood Weltvision Generator; 2-Channel Guitar Preamplifier, Pt.3; PIC Programmer & TestBed; Wireless Networking.

February 2001: How To Observe Meteors Using Junked Gear; An Easy Way To Repair PC Boards; LI Power Train Controller; Midi-Mate – A MIDI Interface For PCs; Build The Bass Blazer; 2-Metre Elevated Groundplane Antenna; The LP Doctor – Clean Up Clicks & Pops, Pt.2.

March 2001: Driving Your Phone From A PC; Making Photo Resist PC Boards At Home; Big-Digit 12/24 Hour Clock; Parallel Port PIC Programmer & Checkerboard; Protoboards – The Easy Way Into Electronics, Pt.5; Build A Simple MIDI Expansion Box.

April 2001: A GPS Module For Your PC; Dr Video – An Easy-To-Build Video Stabiliser; A Tremolo Unit For Musicians; Minimitter PM Stereo Transmitter Modification; Battery Charger; Computer Tips – Tweaking Internet Connection Sharing.

May 2001: Powerful 12V Mini Stereo Amplifier; Microcontroller-Based 4-Digit Counter Modules; Two White-LED Torches To Build; A Servo With Limit Switches; PowerUp – A Multi-Voltage Power Supply; Using Linux To Share An Internet Connection, Pt.1; Computer Tips – Tweaking Windows With Tweak!!.

June 2001: Fast Universal Battery Charger, Pt.1; Phonome – Call, Listen In & Data Logger; Dr Video, Pt.2; Off, LI Switcher – A Low-Cost Automatic Camera Switcher; Build a PC Games Port Tester; Using Linux To Share An Internet Connection, Pt.2; A PC To Die For, Pt.1.

July 2001: The HeartMate Heart Rate Monitor; Do Not Disturb Telephone Timer; Pic-Toc – A Simple Alarm Clock; Fast Universal Battery Charger, Pt.2; A PC To Die For, Pt.2; Computer Tips – Backing Up Your Email; Digital Amplifiers Are Here (Feature).

August 2001: Direct Injection Box For Musicians; Build A 200W Mosfet Amplifier Module; Headlight Reminder For Cars; 40MHz 6-Digit Frequency Counter Module; A PC To Die For, Pt.3; Using Linux To Share An Internet Connection, Pt.3.

PLEASE NOTE: November 1987 to March 1989, June 1989, August 1989, December 1989, May 1990, February 1991, June 1991, August 1991, February 1992, July 1992, September 1992, November 1992, December 1992, May 1993, February 1996 and March 1998 are now sold out. All other issues are presently in stock. For readers wanting articles from sold-out issues, we can supply photostat copies (or tear sheets) at $7.70 per article (includes p&p). When supplying photostat articles or back copies, we automatically supply any relevant notes & errata at no extra charge. A complete index to all articles published to date is available on floppy disk for $11 including p&p, or can be downloaded free from our web site: www.siliconchip.com.au

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How do servos work

I understand the basics of the theory of proportional radio control but have you ever published an article about what the inside of a servo looks like? Obviously, the servo plugs straight into the receiver of the radio control unit but I was wondering what the motor is like, what limits its movement, etc. (B. T., via email).

● We published an article on servos, including an exploded diagram, in the March 1991 issue. We represented the article in November 1997.

Power rating for speed controller

I built your motor speed controller from the November 1997 issue (Dick Smith Electronics kit). It works well in testing but I haven't loaded it up yet. I notice in the inset titled "What Motors Can Be Controlled?" you state that the controller is only suitable for "intermittently used power tools". I guess that means it's not rated for continuous use. What is the duty cycle of the controller? (C. C., via email).

● Our article makes no mention of intermittent use. Provided the case does not get hot to the touch, there is no reason why it cannot be used continuously.

Bigger transformer for 500W amplifier

I was just wondering about the limitations of the 500W amplifier designed back in August, September & October 1997. The reason I'm interested is that I bought eight of these from Jaycar as an investment. At the time, I didn't have the cash for the power supply but I now have the funds to finally finish these pieces of art. However, I have noticed that the original 800VA (57V-0-57V) toroidals are no longer available. Would two 500VA (65V-0-65V) do the trick for each amplifier?

Considering these toroidals have a higher voltage, would I need capacitors with a higher voltage capacity? Would higher capacitance help as well? I'm not expecting huge gains from the amplifier; just another 50-100W of headroom. Will the amplifier drive 2-ohm loads with the higher spec components? (M. G., Glenorie, NSW).

● First, you cannot substitute a transformer with 65V windings as this will increase the amplifier supply rails to over 90V and increase the overall amplifier dissipation by 30%! We suggest you contact Harbuch Electronics on (02) 9476 5854. They can wind suitable transformers to order.

We do not recommend operation with 2-ohm loads as it will exceed the safe operating area ratings (SOAR) of both the output transistors and the driver transistors – see Fig.2, page 27 of the August 1997 issue.

Tone controls for bass guitar

I had success in assembling the guitar preamp and a 120W power amplifier and was delighted that it worked first time. The unit is for a bass guitar for my son and this is where my question arises. Can you supply me with substitute values for the tone control stage to suit a bass guitar? I am not sure what the treble and bass midpoints are but possibly 400Hz and 4kHz? (J. P., via email).

● We don't know which guitar preamplifier you assembled: the January 1992 design or the November 2000 design. Either way, we would not change the tone control. There is very little treble from a bass guitar and increasing the treble boost will only increase the residual noise. Nor would we change the bass crossover as it is likely to lead to premature overload.

Parts for 24V battery charger

I have been searching for a suitable 24V battery charger for some restored railway carriages and have found the "Automatic 10 Amp Charger" in the June 1996 issue. There are no suppliers for this project and some of the components are proving difficult to source. They are:

Can SLA batteries be topped up?

Some time ago, I built the Mk1 version of your Universal Battery Charger and have a few queries:

(1) I have a 6V 5Ah SLA lantern battery which I have difficulty in charging. The charger 100% LED will light when this battery is connected, even if it is discharged.

(2) It is not recommended to top up Nicad batteries because of the "memory effect". However, is it possible to do this with an SLA battery so that my lantern torch is always on maximum capacity when I take it away on trips?

(3) I am interested in radio control modelling and use my charger to charge transmitter (9.6V), receiver (4.8V) and field packs (7.2V). I would like to be able to use the charger in the field. Therefore, is it possible for you to design a modification for both Mk1 and Mk2 models to operate from a 12V car battery? (D. M., via email).

● The Mk1 version of the charger sometimes had problems with particular cells or batteries. Your charging problem could be solved by upgrading to the Mk2 version.

You can top up SLA batteries as these are "sealed lead acid" chemistry and do not have the Nicad memory effect.

The charger is not suitable for operating on 12VDC as the circuit has been optimised for use with raw DC (from a transformer and bridge rectifier).

(1) "E-type ferrite transformer with bobbin, Jaycar LF-1270 or similar". The current product with that Jaycar Cat. No. is an inductor and not the said transformer.

(2) ETD 29 transformer assembly.

(3) BYV32-200. I presume there is an updated equivalent but not sure how critical it is. (R. P., via email).

● The ETD29 is available from Farnell Electronics. Their catalog number is 305-6375 for each core (2 required), 178-506 for the bobbin and 178-507 for clips (2 required).

The T1 transformer is not available from Jaycar now. You could use an EFD25 which will almost fit in the PC board holes but redrilling the holes will allow this to be used. The Farnell catalog numbers for this are 200-300 for the cores (2 required), 200-311 for bobbin and 200-323 for clips (2 required).

The BYV32-200 is also available from Farnell. The Cat. number is 250-650.

Is CDI dangerous for a motor bike?

I built the HEI (high energy ignition) kit for my Falcon not too long ago. I am very impressed with it. Now I would like to try something different and build the Multi-Spark Capacitor Discharge Ignition (CDI) described in September 1997, for a motor bike. I have a few problems that you may have answers for. The bike that I would like to put this on has a 4-cylinder 250cc 16-valve engine.

My main concern is that it is such a small engine and the high energy spark may arc to the aluminium head and damage it in the long term. The spark plugs under the normal twin-coil system produce a rather pathetic spark at higher revs.

Spark plug sizes are somewhat smaller than that of a car. The cylinder has a small 30mm stroke. Peak revs are at 17,000 rpm after which it redlines to 19,500 rpm. The cylinder configuration is two up, two down; ie, two outer cylinders up while the two centre cylinders are down. They fire in a 1 3 4 2 sequence.

Do you have any comments or suggestions?

● While the CDI does have high energy, the actual spark voltage depends on the cylinder pressure. When the engine is under load, the cylinder pressures are higher and the voltage across the spark plug will rise to a higher voltage before it fires. But there is no danger of damage to the cylinder heads, even if there was an arc-over, which is highly unlikely.

Calibrating the digital fuel mixture display

I am building the Digital Fuel Display described in the September & October 2000 issues of SILICON CHIP.

In the instruction section for calibrating the air/fuel meter, it describes the procedure for setting the trimpots for a Bosch EGO sensor with an output of 0-1V. It also states that if you have the output specs for the EGO sensor in your car you can trim these pots to suit.

In the workshop manual for my 1994 Ford Falcon it says that the EGO sensor has an output from 0.33V to 1.1V. Can I tune the meter for this and do I make the span from 0.33V to 1.1V instead of 0V to 1V? Also, will this change the lambda to a different value? (B. B., via email).

● You can set the span and offset to 1.1V and 330mV if you need to. However, the actual curve shape will still follow the Bosch sensor as programmed. A complete curve match would require adjusting the curve lookup table in the program.

The 0.6V stoichiometric point should not change much with a different offset voltage.

How to wind coils with enamelled wire

I have a quick query on the MiniMitter (April 2001) that I am currently constructing. I am not quite sure how to construct coils L1 and L2. Does the enamelled copper wire need to be soldered to the pins on the

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Kit wanted for rust prevention

On many occasions when I have been to car shows, I have seen a product that prevents rust by electronic means. These units are generally housed in a small aluminium case and are only about the size of cassette for a motorbike and double that size for standard vehicle. They connect to the frame and use the 12V wiring from the vehicle. I absolutely have no idea how it is possible to completely stop rust, especially by electronic means!

If they work as well as the representatives say, I would like to know whether it is feasible to make a kit that would do the same job? I'd assume it would be a popular kit, especially for those of us that own older "non plastic" cars.

Also, it has been seven months since I converted my Ford XC V8 to the High Energy Ignition plus Hall Effect sensor system. It has been the best investment that I have made on the car so far! The engine is extremely smooth and quiet on idling. I dare say that the fuel economy would compare to the latest engines found in 4WD and bigger family wagons! (A. P., via email).

● We do not believe these electronic rust preventers can work since they do not involve a sacrificial anode. In any event, they are usually fitted by dealers to new cars (gives them extra profit) and since new cars take years to rust, few people would complain that the rust preventer does not work.

Glad the HEI works well – it certainly does make engines much smoother.

former? If so, how is this done? I have tried unsuccessfully, only managing to deform the foot of the former with the heat. (I. C., via email).

● We generally give fairly detailed info on winding coils but this time we forgot. You have to scrape the enamel off the copper wire before you can solder to it. Scrape it off, tin it with solder and then solder it to the pins on the coil formers.

Gas sensor project

Did you ever feature a gas detector in your magazine? A fellow worker seems to think he saw one in one of your magazines. (M. M., via email).

● We published a carbon monoxide (exhaust gas) monitor in the July 1989 and May 1999 issues. We also published a breath tester in October 2000. We can supply these issues for $7.70 each including postage.

BASIC is still free

In "Ask Silicon Chip" for the July 2001 issue, you stated that GWBASIC/QBASIC interpreters were supplied free until DOS 6. In fact, Microsoft freely supplies the MS-DOS 6.22 version of QBASIC, together with on-line help, in the **\other\oldmsdos** folder of the Win95 CD.

I suspect that the Win98 CD may also include it. Another interesting Win95B freebie is **HwDiag.exe** which is found in the **\other\misc\hwtrack** folder. (F. Z., via email).

● Oops, you're right. On the Win98 CD, it's in the **\tools\oldmsdos** folder. The two files required are QBASIC.EXE and QBASIC.HLP.

Updating the multi-purpose charger

I previously built the original Fast Multi-Purpose Battery Charger as described in the February & March 1998 issues of SILICON CHIP. I now want to update it to your new design but I am a bit confused about the winding of the main switching inductor L1. In your original design, you require 10 turns bifilar wound of 1mm copper wire, thus a total of 20 turns of wire.

In your latest design, you call for 20 turns bifilar wound which, by my interpretation of Fig.3 on p70 of the July 2001 issue, would make a total of 40 turns. Which is the correct number of turns to use? (B. H., New Town, Tas).

● You can leave the number of turns on L1 as per the original version. (10 turns). The circuit will operate with either winding setup.

Clifford the cricket is mute

I am building Clifford the Cricket, as described in the December 1994 issue. I have put all the components in correctly and have also tried replacing the IC and both transistors but the circuit still refuses to work. The LEDs light but the buzzer just provides a low constant clicking sound. I have checked the buzzer and it seems OK. Can you suggest anything? (C. M., via email).

● The oscillator for the piezo buzzer is possibly too fast for any chirping sound to be heard. Try changing the .047µF capacitor between pins 8 & 9 of IC1 to a larger value. A 0.22µF capacitor might be a good start. Also, the flashing rate for the LEDs can be varied by adjusting the 2.2µF capaci-

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More information on the PIC Testbed

I have some questions on the PIC Testbed published in the January 2001 issue. I know that I have successfully downloaded the program (.asm file) to the testbed (16F84). I assume that I need to set the jumper on the testbed for the clock when programming and I know that the program was downloading to the chip (by connecting the LEDs when programming. By the way, if the LEDs are left connected when programming, the chip will not program successfully). But I am unsure as to how to set the program in motion when it is downloaded.

Also, I have questions on the COM port on the board. I tried to use the COM port (built onto the board) before realising that it was nearly pointless doing so as it is not supported by any of the software I have tried so far and also because of the differences in support protocol. (M. C., via email).

● The program should run (meaning the LEDs should chase) as soon as you disconnect the programming adapter cable and press the reset button. From your description, we assume you have selected the 4MHz crystal as the clock source, which is the correct option for the DEMO & TESTBED programs.

We have recently updated the little DEMO & TESTBED programs, as well as created a slightly modified version that will work with the RC oscillator.

Regarding the serial port, you're quite correct in your assumption that you need to download a program to drive the port. A good starting point might be a little terminal program that receives characters from the serial input line and displays them on the LCD. You will find numerous examples to get you started on the 'net. Check out Microchip's application notes first at **www.microchip.com**

tor value at pins 11 & 12 of IC1. A larger value will slow down the rate. A smaller value will speed it up.

Deep cycle vs auto batteries

I'm under the impression that car-type 4WD starter batteries do not like being drained of more than 20% of their capacity. I think that they where intended for starting only and not storage. As I have a 4WD and no extra battery, I thought a deep-cycle battery might be better. That way, more capacity can be used without damage to the battery. I know that a deep cycle battery would be more expensive. (G. M., via email).

● As a general rule, all car and truck batteries have a very poor life expectancy if they are frequently subject to heavy discharge. In normal conditions, the vehicle alternator takes all the electrical load and so the battery does little except for its starting role which normally only causes a brief and very shallow discharge. If you are having electrical problems, the solution may be to install a bigger alternator.

Notes & Errata

12/24 Hour Giant Clock, March 2001: as published, in the 24-hour mode the clock changes from 23.59.59 to 24.00.00. This is now changed to the correct 24-hour transition from 23.59.59 to 00.00.00. The upgraded software is called clock1.asm and clock1.hex and is available on the SILICON CHIP website.

DI Box, August 2001: the tip contact and integral switch contact in the DC jack socket on the circuit on page 14 are shown reversed; ie, the tip contact should go to switch S1 while the integral switch contact should go to the battery negative. The wiring diagram on page 16 is correct.

The parts list on page 19 does not include VR5 which should be a 16mm 10kΩ linear potentiometer.

Also the testing instructions on page 19 do not tell how to adjust VR5. To do so, connect a DMM across the bass pot VR2 and adjust VR5 for zero DC voltage.

This eliminates any DC current through the bass control and stops it from becoming noisy. **SC**

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